AMETEK®
PROGRAMMABLE POWER

Sorensen
SGI Series DC Power Supplies
Operation Manual

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Product Family: SGI Series DC Power Supplies

Warranty Period: Five Years

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1. Request a Return Material Authorization (RMA) number from the repair facility (**must be done in the country in which it was purchased**):
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   - Telephone: 800-733-5427, ext. 2295 or ext. 2463 (toll free North America)
     858-450-0085, ext. 2295 or ext. 2463 (direct)
   - **Outside the USA**, contact the nearest Authorized Service Center (ASC). A full listing can be found either through your local distributor or our website, www.programmablepower.com, by clicking Support and going to the Service Centers tab.
2. When requesting an RMA, have the following information ready:
   - Model number
   - Serial number
   - Description of the problem

Note: *Unauthorized returns will not be accepted and will be returned at the shipper’s expense.*

Note: *A returned product found upon inspection by AMETEK, to be in specification is subject to an evaluation fee and applicable freight charges.*

IMPORTANT SAFETY INSTRUCTIONS

Before applying power to the system, verify that your product is configured properly for your particular application.

WARNING!

Hazardous voltages might be present when covers are removed. Qualified personnel must use extreme caution when servicing this equipment. Circuitry, test points, and output voltages might be floating with respect to chassis ground. Do not touch electrical circuits, and use appropriately rated test equipment. A safety ground wire must be connected from the chassis to the AC mains input when servicing this equipment.

WARNING!

This equipment contains ESD sensitive input/output connection ports. When installing equipment, follow ESD safety procedures. Electrostatic discharges might cause damage to the equipment.

Only *qualified personnel,* who understand and deal with attendant hazards in power supplies, are allowed to perform installation and servicing.

Ensure that the AC mains input ground is connected properly to the chassis safety ground connection. Similarly, other power ground lines, including those to application and maintenance equipment, *must* be grounded properly for both personnel and equipment safety. Always ensure that facility AC mains input is de-energized prior to connecting or disconnecting any cable.

In normal operation from the front panel, the operator does not have access to hazardous voltages within the chassis. However, depending on the application configuration, **HIGH VOLTAGES HAZARDOUS TO HUMAN SAFETY** might be normally generated on the output terminals. The user must ensure that the output power lines are labeled properly as to the safety hazards and that any possibility for inadvertent contact with hazardous voltages is eliminated.

Guard against risks of electrical shock during open cover checks by not touching any portion of the electrical circuits. Even when power is off, capacitors may retain an electrical charge. Use safety glasses during open cover checks to avoid personal injury by any sudden component failure.

Neither AMETEK Programmable Power Inc., San Diego, California, USA, oor any of the subsidiary sales organizations, can accept any responsibility for personnel, material or inconsequential injury, loss or damage that results from improper use of the equipment and accessories.

SAFETY SYMBOLS

WARNING: Electrical Shock Hazard

HAZARD: Strong oxidizer

GENERAL WARNING/CAUTION: Read the accompanying message for specific information.

BURN HAZARD: Hot Surface Warning. Allow to cool before servicing.

DO NOT TOUCH: Touching some parts of the instrument without protection or proper tools could result in damage to the part(s) and/or the instrument.

TECHNICIAN SYMBOL: All operations marked with this symbol are to be performed by qualified maintenance personnel only.

ELECTRICAL GROUND: This symbol inside the instrument marks the central safety grounding point for the instrument.

FCC NOTICE

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment.

This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

ABOUT THIS MANUAL AND REGULATORY COMPLIANCE

This manual has been written for the Sorensen SGI Series of power supplies, which have been designed and certified to meet the Low Voltage and Electromagnetic Compatibility Directive Requirements of the European Community.

These models have been designed and tested to meet the Electromagnetic Compatibility directive (European Council directive 2004/108/EC; generally referred to as the EMC directive) and to the requirements of the Low Voltage directive (European Council directive 2006/95/EC, 93/68/EEC, dated 22 July 1993). In addition these models have been found compliant with FCC 47 CFR Part 15, Subpart B107(e) Class A, 109(g) Class A.

Since the Low Voltage Directive is to ensure the safety of the equipment operator, universal graphic symbols have been used both on the unit itself and in this manual to warn the operator of potentially hazardous situations (see Safety Instruction page).

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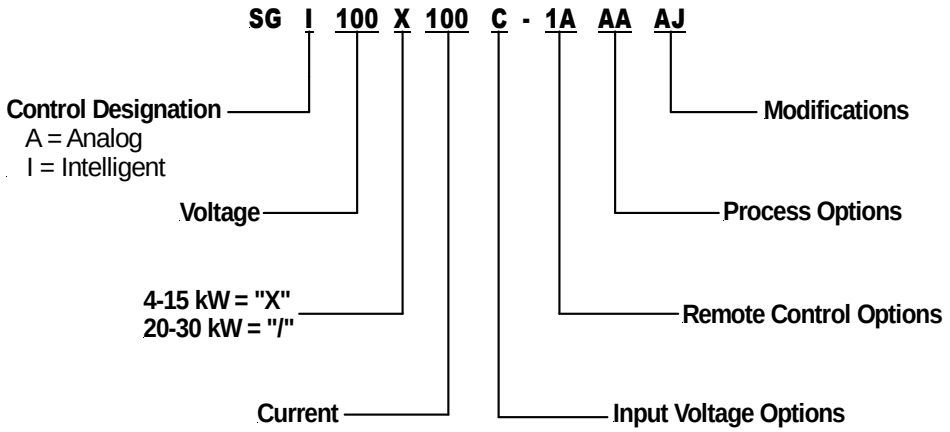
SECTION 1
OVERVIEW

1.1 General Description

The Sorensen SGI Series are general purpose power supplies designed specifically for laboratory test and systems applications requiring programmable DC sources with good performance characteristics, such as accuracy, regulation, and ripple/noise. These power supplies are constant-current/constant-voltage supplies with an automatic crossover feature.

A variety of user interfaces are available, ranging from manual front panel control and standard non–isolated remote analog control, to optional GPIB or isolated remote analog control.

Refer to Figure 1-1 for decoding of the SG Series model number.



For units up to 999 V/999 A, voltage and current are represented in numeric format, e.g., “100” represents 100 V. For units at 1000 V/1000 A and above, the voltage and current are represented by the format “xKx”, e.g., “1K0” represents 1000 V.

Option	Description
Control Options	A: Analog I: Intelligent
Input Options	C: Input Voltage 208/230 VAC, 3-Phase D: Input Voltage 380/400 VAC, 3-Phase E: Input Voltage 440/480 VAC, 3-Phase
Remote Control Options	0A: No Option 1A: IEEE-488.2 + RS-232C 1C: Ethernet + RS-232C 1D: Isolated Analog Interface 1E: Shaft Locks 2A: Combined Options 1A + 1D 2C: Combined Options 1A + 1E (SGA Only) 2G: Combined Options 1C + 1D 2H: Combined Options 1C + 1E (SGA Only) 2J: Combined Options 1D + 1E (SGA Only) 3C: Combined Options 1A + 1D + 1E (SGA Only) 3G: Combined Options 1C + 1D + 1E (SGA Only)
Process Options	AA: No option AB: Certificate of Calibration (includes test data)
Modifications	AJ: Front panel dust filter (3U models only) CV: 400Hz AC input at 208 VAC for 6U units only; does not carry CE, CSA or UL certification; (standard in 3U models) PF: Passive power factor correction to 0.9 for 40V to 800V models; (standard in 10V-30V, 50V, and 1000V models)

Figure 1-1. Model Number Decoding

1.2 Specifications

The following subsections provide environmental, electrical, and physical characteristics for the SGI Series power supplies.

Note: *Specifications are subject to change without notice.*

Note: *The SGI Series power supplies are intended for indoor use only. Refer to Section 2.3 for use/location requirements.*

1.2.1 Environmental Characteristics

Parameter	Specification
Ambient Temperature	
Operating	0 to 50°C
Storage	-25° to 65°C
Cooling	Forced convection with internal, linearly-variable-speed fans; vents on front, sides and rear; units may be stacked without clearance above or below.
Humidity	95% maximum, non-condensing, 0 to 50°C; 45°C maximum wet-bulb temperature.
Altitude	5,000 ft (1,524 m) operating at full rated output power, derate 10% of full power for every 1,000 ft (3,048 m) higher; non-operating to 40,000 ft (12,192m)
Agency Approvals	CE Compliant: Certified to UL/CSA 61010 and IEC/EN 61010-1 by a NRTL; LVD Categories: Installation Category II, Pollution Degree 2, Class II Equipment, for Indoor Use Only; EMC Directive, EN 61326:1998; Semi-F47 Compliant

1.2.2 Electrical Characteristics

Note: *Output voltage accuracy, regulation, and stability specifications are valid at the point where the remote sense leads are connected.*

Parameter	Specification
Input Power	
Voltage	208/230 VAC ±10%, allowed range 187-253 VAC; 380/400 VAC ±10%, allowed range 342-440 VAC; 440/480 VAC ±10%, allowed range 396-528 VAC
Frequency	47 Hz to 63 Hz; 400 Hz at 208 VAC for 3U models; 400 Hz at 208 VAC for 6U models is an optional modification (“CV” in model number) and does not carry CE, UL or CSA markings
Configuration	3–phase, 3–wire plus ground; not phase rotation sensitive; neutral not used.

Parameter	Specification
Power Factor (at full rated load; 50/60Hz); contact factory for power factor of specific models	
PFC models: 10V-30V, 50V, 1000V, and models with optional modification, “PF”	0.90, typical, for all AC input ratings; with passive power factor correction (PFC)
Non-PFC models: 40V-800V	0.75, typical, for 208/230 VAC input; 0.72, typical, for 380/400 VAC input; 0.69, typical, for 440/480 VAC input; power factor is not solely determined by power supply input characteristics, but is dependent on the level of DC output power and interaction with the source impedance of AC mains.
Efficiency	87%, typical, at full load, nominal AC line
Hold-Up Time	1/2 cycle, typical, for loss of all three phases (6.4 ms, typical for 800V/1000V models); 3 cycle, typical, for loss of one phase; sustained missing phase will result in shutdown of the output.
Rated Output Power	4-15 kW for 3U chassis for10V-30V models; 5-15 kW for 3U chassis for 40V-1000V models; 20-30 kW for 6U chassis for 60V-600V models; maximum output power is the product of the rated output voltage and current; for specific values refer to Section 1.2.3.
Load Regulation (specified for ±100% rated load change, at nominal AC input voltage)	
Voltage	±0.05%, maximum, of rated output voltage for 10V- 30V models; ±0.02%, maximum, of rated output voltage for 40V-1000V models
Current	±0.1%, maximum, of rated output current
Line Regulation (specified for ±10% change of nominal AC line voltage, at constant load)	
Voltage	±0.05%, maximum, of rated output voltage for 10V-30V models; ±0.01%, maximum, of rated output voltage for 40V-1000V models
Current	±0.05%, maximum, of rated output current
Temperature Coefficient	
Voltage	±0.02%/°C, typical, of rated output voltage
Current	±0.03%/°C, typical, of rated output current
Stability	±0.05%, typical, of rated output voltage or current, over 8 hrs at fixed line, load, and temperature, after 30 min warm-up
Output Voltage Ripple/Noise	Refer to Ripple/Noise specifications in tables of Section 1.2.3.
Load Transient Response	1 ms, typical, to recover within 0.75% of rated output voltage for load step change of 50% of rated output current
Output Voltage Rise Time (with rated load, resistive; current rise time same)	10 ms, maximum, from 10-90% of programming change from zero to rated output voltage for 10V-30V models; 100 ms, maximum, from 5-95% of programming change from zero to rated output voltage for 40V-1000V models; contact factory for values of specific models

Parameter	Specification
Output Voltage Fall Time (with rated load, resistive; current fall time same)	10 ms, maximum, from 90-10% of programming change from rated output voltage to zero for 10V-30V models; contact factory for values of specific models
Output Voltage Fall Time (with no load)	50 ms, maximum, from 90-10% of programming change from rated output voltage to zero for 10V-30V models; 1.5 s, typical, from 100% to 10% of programming change from rated output voltage to zero for 40V-1000V models; contact factory for values of specific models
Front Panel Meter	
Display Resolution	4 digit
Voltage Accuracy (to actual output)	±(0.15% of rated output voltage + 0.1% of actual output + 1 digit) for 10V-30V models; ±(0.1%, maximum, of rated output voltage + 1 digit) for 40V-1000V models
Current Accuracy (to actual output)	±(0.4%, maximum, of rated output voltage + 1 digit)
Front Panel Programming	
Voltage	±(0.1% of rated output voltage + 0.1% of actual output voltage) for 10V-30V models; ±0.1%, maximum, of rated output voltage for 40V-1000V models
Current	±(0.4% of rated output current + 0.1% of actual output current) for 10V-30V models; ±0.4%, maximum, of rated output current for 40V-1000V models
Overvoltage Protection (OVP)	±1%, maximum, of rated output voltage
Remote Sensing	
Connection	Voltage accuracy/regulation specifications apply at the point where the remote sense leads are connected.
Line Drop	1 V, maximum per line for 10V-20V models; 1.5 V, maximum per line for 30V model; 5%, maximum of rated output voltage per line for models, 40V to less than 160V; 2%, maximum of rated output voltage per line for models greater than or equal to 160V; greater level of line drop is allowed, but output voltage regulation specifications no longer apply.
Line Drop Effect on Output Voltage	Rated output voltage applies at the rear panel output terminals, and line drop voltage subtracts from the voltage available at the load terminals
Remote Analog Interface	
Programming Accuracy	
Voltage	±0.25%, maximum, of rated output voltage for 0-5 VDC range, and ±0.5%, maximum, for 0-10 VDC range
Current	±1.0%, maximum, of rated output current for 0-5 VDC range, and ±1.2%, maximum, for 0-10 VDC range for 10V-30V models;

Parameter	Specification
	±0.8%, maximum, of rated output current for 0-5 VDC range, and ±1.0%, maximum, for 0-10 VDC range for 40V-1000V models
Overvoltage Protection (OVP)	±1%, maximum, of rated output voltage
Readback Monitor Accuracy	
Voltage (of actual output value)	±0.5%, maximum, of rated output voltage
Current (of actual output value)	±1%, maximum, of rated output current
Resistive-Control Programming	
Voltage	0–5 kΩ for 0-100% of rated output voltage
Current	0–5 kΩ for 0-100% of rated output current
Voltage-Control Programming	
Voltage	0–5 VDC or 0–10 VDC for 0-100% of rated output voltage
Current	0–5 VDC or 0–10 VDC for 0-100% of rated output current
Overvoltage Protection (OVP)	0.25–5.5 VDC for 5-110% or rated output voltage
Remote Control/Monitor Interface	On/Off control via contact closure, 6-120 VDC or 12-240 VAC, and TTL or CMOS gate; output voltage and current monitors; output voltage, current, and OVP programming; summary fault status
Output Isolation	
Output Float Voltage	
Negative Output Terminal	±300 V(PK), maximum, with respect to chassis ground; exceeding the limit will be detected as a fault by a protective supervisory monitor and shutdown of the output will be executed; this condition will be latched, requiring reset to resume normal operation.
Isolation of optional Isolated Analog Interface (J1) to output negative terminal	1000 V(PK), maximum; Isolated Analog Interface (J1 signals) are galvanically isolated from negative output terminal; operation of Isolated Analog Interface signals should be at SELV safety voltage conditions to chassis ground.
Reference of standard Non-Isolated Analog Interface (J1) to output negative terminal	The standard Non-Isolated Analog Interface (J1 signals) is connected to the negative output terminal and, therefore, is not isolated from the output.
Parallel Operation	
Parallel Group	Up to 5 units, of the same voltage rating, may be connected in parallel for additional output current; specifications apply as for single unit, with the exception that each additional paralleled unit will add 0.3% to the output current accuracy. Contact factory for applications requiring paralleling more than five units.
Series Operation	
Series Group	Up to 2 units, of the same current rating, may be connected in series for additional output voltage; see restrictions in Output Isolation section.

1.2.3 SGI Series Voltage and Current Specifications

The following tables present the specifications for rated voltage and current, and ripple/noise for the 10V-1000V models.

Rated Voltage, VDC	Rated Current, ADC						Ripple/ Noise** RMS, mV	Ripple/ Noise* PK–PK, mV
	4 kW	5 kW	8 kW	10 kW	12 kW	15 kW		
0-10††	0-400	N/A	0-800	N/A	0-1200	N/A	20	50
0-15††	0-267	N/A	0-534	N/A	0-801	N/A	20	50
0-20††	N/A	0-250	N/A	0-500	N/A	0-750	20	60
0-30††	N/A	0-167	N/A	0-334	N/A	0-501	20	60

Rated Voltage, VDC	Rated Current, ADC						Ripple/ Noise** RMS, mV	Ripple/ Noise* PK–PK, mV
	5 kW	10 kW	15 kW	20 kW	25 kW	30 kW		
0-40	0-125	0-250	0-375	0-500†	0-625†	0-750†	20	75
0-50	0-100	0-200	0-300	0-400†	0-500†	0-600†	20	75
0-60	0-83	0-167	0-250	0-333	0-417	0-500	20	75
0-80	0-63	0-125	0-188	0-250	0-313	0-375	20	100
0-100	0-50	0-100	0-150	0-200	0-250	0-300	20	100
0-160	0-31	0-63	0-94	0-125	0-156	0-188	25	150
0-200	0-25	0-50	0-75	0-100	0-125	0-150	25	175
0-250	0-20	0-40	0-60	0-80	0-100	0-120	30	200
0-330	0-15	0-30	0-45	0-61	0-76	0-91	30	200
0-400	0-12	0-25	0-38	0-50	0-63A	0-75	30	300
0-500	0-10	0-20	0-30	0-40	0-50	0-60	50	350
0-600	0-8	0-17	0-25	0-33	0-42	0-50	60	350
0-800	0-6.2	0-12.5	0-18.7	0-25†	0-31.2†	0-37.5†	80	500
0-1000	0-5	0-10	0-15	0-20†	0-25†	0-30†	100	650

***** PK-PK ripple/noise, over 20 Hz to 20 MHz bandwidth, is measured across a 1 µF capacitor at the end of a 6' load cable with the supply operating at full load and nominal AC line voltage.

****** RMS ripple/noise, over 20 Hz to 300 kHz bandwidth, is measured directly across the output terminals with the supply operating at full load and nominal AC input line voltage.

† Power level not available in 6U models, but could be produced with paralleled 3U units; up to 75 kW could be produced by paralleling up to five power supplies. Paralleling will increase ripple/noise.

†† Models from 10V-30V are not available in 6U chassis.

1.2.4 Physical Characteristics

Dimensions	3U Models, 10V-30V	3U Models, 40V-1000V	6U Models, 60V-600V
Width	19.00 in (48.26 cm)	19.00 in (48.26 cm)	19.00 in (48.26 cm)
Depth	From inner surface of front panel to maximum protrusion of protective covers at rear panel; refer to installation drawings for chassis dimensions.		
	28.09 in (71.35 cm)	25.46 in (64.67 cm)	27.18 in (69.04 cm)
Height	5.25 in (13.34 cm)	5.25 in (13.34 cm)	10.5 in (26.67 cm)
Weight (nominal)	≤ 65 lb (29 kg), (4 kW, 10V, 15V) ≤ 65 lb (29 kg), (5 kW, 20V, 30V) ≤ 85 lb (39 kg), (8 kW, 10V, 15V) ≤ 85 lb (39 kg), (10 kW, 20V, 30V) ≤ 110 lb (50 kg), (12 kW, 10V, 15V) ≤ 110 lb (50 kg), (15 kW, 20V, 30V)	≤ 60 lb (27 kg), (5 kW) ≤ 75 lb (34 kg), (10 kW) ≤ 90 lb (41 kg), (15 kW)	≤ 140 lb (63 kg), (20 KW) ≤ 155 lb (70 kg), (25 kW) ≤ 170 lb (77 kg), (30 kW)
Shipping Weight	Contact factory for weights of specific models		

SECTION 2
INSTALLATION

2.1 Inspection

Inspect the shipping carton for possible damage before unpacking the unit. Carefully unpack the equipment. Save all packing materials until inspection is complete. Verify that all items listed on the packing slips have been received. Visually inspect all exterior surfaces for broken knobs, connectors, or meters. Inspect for dented or damaged exterior surfaces. External damage may be an indication of internal damage. If any damage is evident, immediately contact the carrier that delivered the unit and submit a damage report. Failure to do so could invalidate future claims. Direct repair issues to Customer Service at 858-458-0223 (local) or 1-800-733-5427 (toll free in North America).

2.2 Contents of Shipment

Depending on the model, configuration, and options available for your SGI Series power supply, the ship kit may include additional parts and accessories.

Minimum items included in the ship kit:

- AMETEK manuals CD-ROM (P/N M550008-01) containing the SGI Series DC Power Supplies Operation Manual (this manual, P/N M550221-01), and the SG manual for the digital interface options, IEEE 488.2/RS232 and Ethernet Programming Manual (P/N M550129-03).
  1. Sense mating connector:

  10V-800V models, (Molex P/N 39-01-4031) with loose contacts (Molex P/N 39-00-0182)

  1000V model, (Molex P/N 39-01-4041) with loose contacts (Molex P/N 39-01-0182)
  2. J1 mating connector (Cinch P/N DB25P or equivalent) normally shipped attached to rear panel J1

  3. Backshell for J1 (DB25) mating connector (Cinch P/N DCH-B-001 or equivalent)

4. Hardware for input/output terminal power connections:

   3U, 4-15 kW, 10V-30V models: 1/2-13UNC-2B x 1.25" long, 4 ea, with nut, washer, and lockwasher;

   3U, 5-15 kW, 40V-600V models: 3/8-16UNC-2B x 1.0”, 2 ea, with nut, washer, and lockwasher;

   3U, 5-15 kW, 800V and 1000V models have studs, 1/4-20UNC-2B, 2 ea, with nut, washer, and lockwasher installed on rear panel;

   6U, 20-30 kW: 3/8-16UNC-2B x 0.875", 2 ea, with nut and lockwasher, for DC output; 1/4-20UNC-2B, 4 ea, with Keps nut for AC input.

5. Front panel rack fastener, black screw:

   3U, 10V -1000V models: 10-32UNC-2B x 0.5”, 4 ea;

   6U, 20-30 kW: 10-32UNC-2B x 0.5”, 8 ea.

Note: *If any of these parts are missing, contact Customer Service at 858458-0223 (local) or 1-800-733-5427 (toll free).*

Optional accessories:

890-453-03: Paralleling Cable (for up to 5 units, requires one cable per unit placed in parallel)

K550212-01: 3U Rack Slides (for 4 kW to 15 kW models)

K550213-01: 6U Rack Slides (for 20 kW to 30 kW models)

5550568-01: Front panel dust filter - field installation kit - 3U models only

5551082-01: Optional AC input cover kit - 3U models only

2.3 Location and Mounting

Refer to Sections 2.7 for dimensional and installation drawings.

WARNING!
This unit is intended for installation in a protected environment. Exposure to conductive contaminants or corrosive compounds/gases that could be ingested into the chassis could result in internal damage. To reduce the risk of fire or electrical shock, install the SGI Series unit in a temperature and humidity controlled indoor area.

CAUTION!
The unit should be provided with proper ventilation. The rear and both sides of the unit should be free of obstructions. To ensure proper airflow, a minimum 4" clearance from the rear air outlet is required. The unit should not be installed in an ambient temperature greater than 50°C.

CAUTION!
No user serviceable parts inside; service to be performed by qualified personnel only.

2.3.1 Rack Mounting

The SGI Series models are designed for mounting in a standard 19-inch equipment rack compliant to EIA-310. If additional instrumentation is mounted in the rack, no additional clearance is required above or below the SGA Series units.

Support the SGI Series unit using appropriate L-brackets or rack mount slides; suggested slides kits are listed as follows:

Rack Mount Slide Kit (Option):

3U models, 4–15 kW: AMETEK part number K550212-01
6U models, 20–30 kW: AMETEK part number K550213-01

2.3.2 K550212-01 ASSEMBLY STEPS (OPTION KIT)

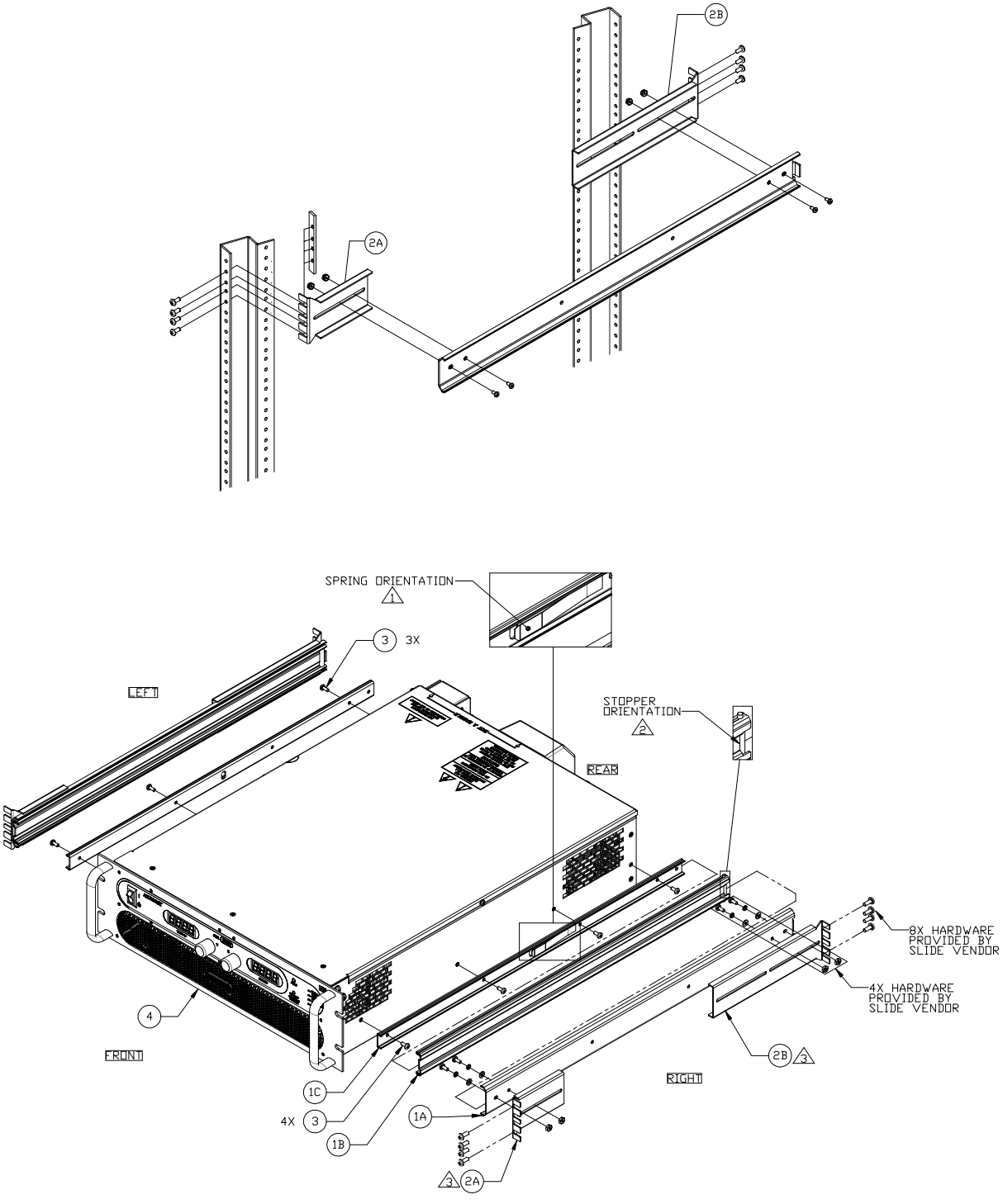


Figure 2-1. Rack Mount Assembly for 3U Models

WARNING!
A minimum two-person lift is required for the 3U SGA Series power supply, which weighs up to 110 lb (50 kg) depending on the model.

Refer to Figure 2-1 for 3U rack mount assembly drawing for the following instructions:

1. Install the slide sections, (1C), on both sides of the power supply chassis with screws (three on left side and four on right side). Ensure that the latch spring orientation is as shown in Note 1 .
2. Install the brackets, (2A) and (2B), to the stationary slide sections, (1A), with the hardware provided by the slide supplier as shown in Note 3.
3. Ensure that stopper orientation of slide sections, (1B), is as shown in Note 2. Adjust the location of the mounting brackets as required for the particular type of cabinet vertical rails utilized.
4. Mount the stationary slide sections, (1A), (with brackets already installed) into the cabinet using appropriate hardware (e.g. bar nuts, cage nuts, clip nuts), while ensuring that they are level front to back and left to right of the cabinet rails.
5. Insert power supply chassis with slide sections, (1C), into slide sections, (1B).
6. Secure the front panel of the power supply chassis to the cabinet rack rails using the screws provided in the ship kit.

2.3.3 K550213-01 ASSEMBLY STEPS (OPTION KIT)

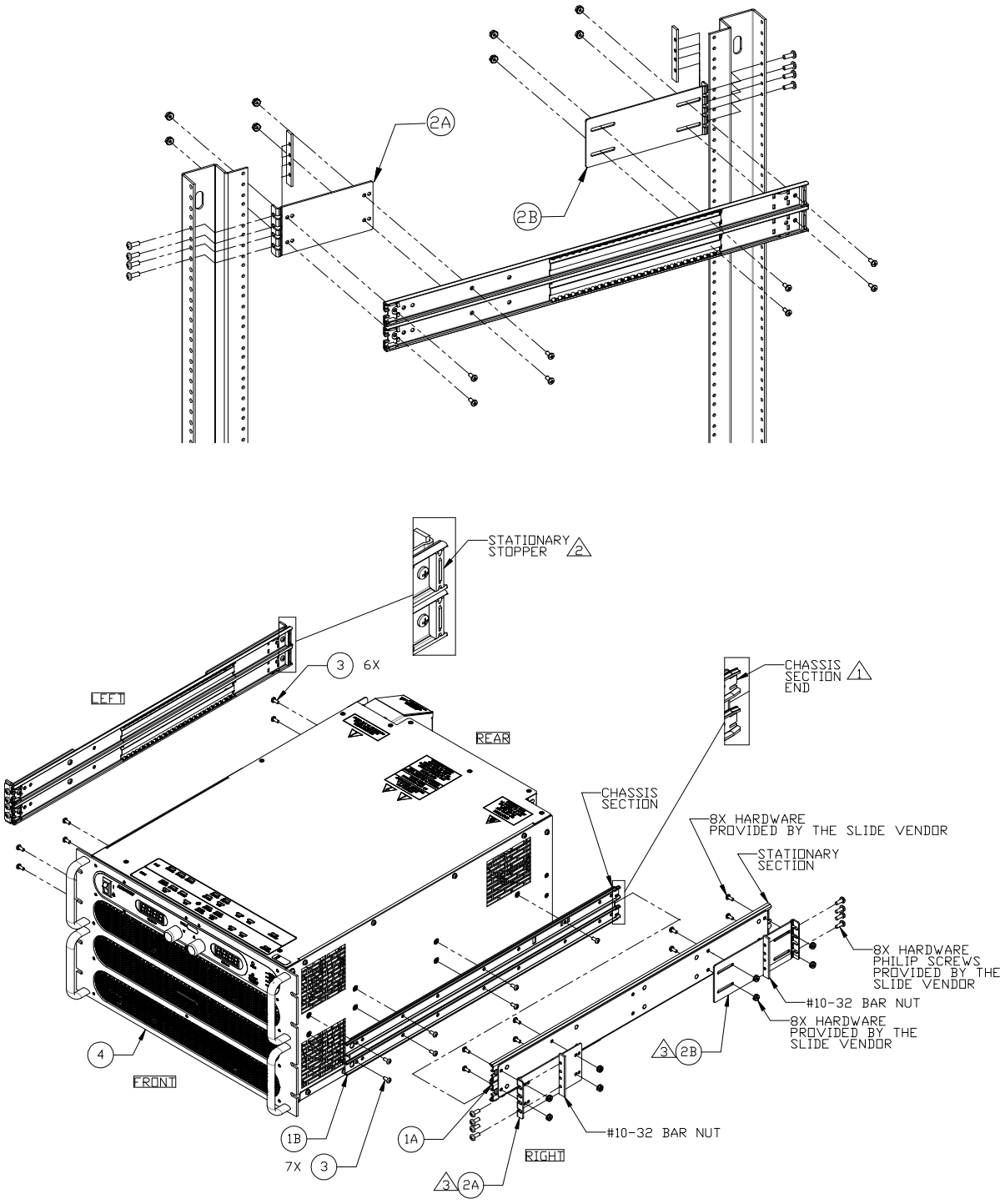


Figure 2-2. Rack Mount Assembly for 6U Models

WARNING!
A minimum three-person lift is required for the 6U SGA Series power supply, which weighs up to 170 lb (77 kg) depending on the model.

Refer to Figure 2-2 for 6U rack mount assembly drawing for the following instructions:

1. Install the slide sections, (1B), on both sides of the power supply chassis with screws (six on left side and seven on right side). Ensure that the section end orientation is as shown in Note △1.
2. Install the brackets, (2A) and (2B), to the stationary slide sections, (1A), with the hardware provided by the slide supplier as shown in Note △3. Ensure that the stopper orientation is as shown in Note △2. Adjust the location of the mounting brackets as required for the particular type of cabinet vertical rails utilized.
3. Mount the stationary slide sections, (1A), (with brackets already installed) into the cabinet using appropriate hardware (e.g. bar nuts, cage nuts, clip nuts), while ensuring that they are level front to back and left to right of the cabinet rails.
4. Insert power supply chassis with slide sections, (1B), into slide sections, (1A).
5. Secure the front panel of the power supply chassis to the cabinet rack rails using the screws provided in the ship kit.

.

2.3.4 Chassis Removal from Rack

WARNING!
A minimum two-person lift is required for the 3U SGA Series power supply, which weighs up to 110 lb (50 kg) depending on the model.
A minimum three-person lift is required for the 6U SGA Series unit, which weighs up to 170 lb (77 kg) depending on the model.

The slides have a front disconnect feature and lock at full extension. To disconnect and remove the chassis from the rack, depress the flat steel spring (located on the slides) inward, and pull the chassis forward. To return the chassis back into the rack from full extension, depress the flat steel spring (located on the slides) inward, and push the chassis back.

When the chassis is at full extension, the flat springs are located behind the front rack rails. Retract the springs with a flat blade screwdriver or similar device to release from lock-out or to remove the chassis from the rack.

2.4 Input/Output Connections

Refer to Table 2–1 for AC input current requirements and Section 1.2.3 for output current specifications. Table 2–3 provides information on the external input and output connections for the SGI Series models. Table 2–4 provides input connections descriptions and Table 2–5 provides output connection descriptions. Refer to Table 2–6 for input/output lug recommendations. The recommended tools for crimping and extraction of the sense connector pins are listed below in Table 2–7.

WARNING!
High voltage present at rear panel! Risk of electrical shock. Do not remove protective covers on AC input or DC output. Refer to qualified service personnel.

WARNING!
The input and output voltages at the rear panel of the unit might be HAZARDOUS LIVE. When rack-mounting or panel-mounting the unit, suitable safeguards must be taken by the installer to ensure that HAZARDOUS LIVE voltages are not OPERATOR accessible. OPERATOR access should only be to the front panel of the unit.

WARNING!
A safety disconnect device for the AC mains input must be installed so that it is readily accessible to the user

WARNING!
A properly sized input overcurrent protection device must be installed at the AC mains input, either a circuit breaker or fuse having a rating of 25% over the maximum AC input line currents listed in Table 2–1.

WARNING!
To prevent an electrical shock hazard, a safety ground wire must be connected from the safety ground stud on the rear panel to the AC mains ground.

CAUTION!
Under no condition should the negative output terminal exceed 300V to earth ground. Floating the negative output terminal subjects the internal control circuitry of the power supply to the same potential as present at the negative output terminal. In a unit with the standard Non-Isolated Analog Interface, the signals of control connector, J1, would float at the same potential as the negative output terminal. Damage might occur if the signals of the Non-Isolated Analog control connector are connected to an external ground referenced device, due to unintentional ground loop currents that this connection could generate. To correct ground loop problems, it is advised to use the optional Isolated Analog Interface in order to isolate the external signals from the internal control circuitry of the supply. Refer to Section 1.2.2 of the specifications for additional information.

Model Ratings			Input Line Current, A (RMS)*					
Voltage Model	**AC Input Option Code**	**Input Voltage, VAC**	**5 kW**	**10 kW**	**15 kW**	**20 kW**	**25 kW**	**30 kW**
40V-1000V	C	208/230	20	39	59	79	98	118
	D	380/400	11	22	32	43	54	65
	E	440/480	9	19	28	37	47	56
			4 kW	**8 kW**	**12 kW**	**5 kW**	**10 kW**	**15 kW**
10V-15V	C	208/230	16	32	47	N/A	N/A	N/A
	D	380/400	9	17	26	N/A	N/A	N/A
	E	440/480	7	15	22	N/A	N/A	N/A
20V-30V	C	208/230	N/A	N/A	N/A	20	39	59
	D	380/400	N/A	N/A	N/A	11	22	32
	E	440/480	N/A	N/A	N/A	9	19	28
* AC input current could vary as a result of actual power factor; refer to specifications section for power factor dependency								

Table 2–1. Maximum AC Current Ratings, PFC Models

Model Ratings			Input Line Current, A(RMS)*					
Voltage Model	**AC Input Option Code**	**Input Voltage, VAC**	**5 kW**	**10 kW**	**15 kW**	**20 kW**	**25 kW**	**30 kW**
40V-800V	C	208/230	24	47	71	95	118	142
	D	380/400	13	27	40	54	67	81
	E	440/480	12	24	36	49	61	73
* AC input current varies depending on actual power factor; refer to specifications section on power factor								

Table 2–2. Maximum AC Current Ratings, Non-PFC Models

Connector	Function	Connection
L1 – AC, L2 – AC, L3 – AC, Chassis - GND	AC input power; see Table 2–4	AC mains 3-phase input
Pos. Bus Bar, Neg. Bus Bar	DC output power; see Table 2–5	User load
Analog Interface Connector (J1)	Control interface; see Table 3–5	User controller
Remote Sense Connector	Remote voltage sensing; see Section 3.14	Output load
Parallel In/Out	Parallel operation; see Section 3.16	Master/Slave units

Table 2–3. Input/Output Connectors

Power Supply Type	Connections	Connection Description
4 kW to 15 kW, 3U	AC Input	Feed-Through terminal block with compression terminals
20 kW to 30 kW, 6U	AC Input	Bus Bar with holes for 1/4"–20 bolts
All 3U and 6U	Chassis Safety Ground	1/4-20 stud

Table 2–4. Input Terminal Connections

CAUTION!
To prevent damage to the AC input connector of the 3U units, follow torque specifications, and, if a wire ferrule is used, ensure that it is properly sized and that it has been crimped with the appropriate ferrule crimping tool.

AC Input Connector for 3U Models

- Recommended torque for the AC input connector screws: 17.7 in-lb to 20.4 in-lb (2 Nm to 2.3 Nm).
- Wire ferrules are recommended, properly sized to match the wire gauge; use appropriate crimp tool for the ferrule size.
- Wire insulation should be stripped to 5/8”, maximum.
- For more information on the AC input connector, refer to the manufacturer (Phoenix Contact) part number HDFKV 16 at their website, www.phoenixcontact.com.

Power Supply Type	Connection Description
4 kW to 15 kW, 10V-30V models	Bus bars with two holes for 1/2” bolts on each terminal (POS. and NEG.)
5 kW to 15 kW, 40V-1000V models	40V-600V models: bus bars with single holes for 3/8" bolts on each terminal (POS. and NEG.) 800V and 1000V models: 1/4-20 studs for each terminal (POS. and NEG.)
20 kW to 30 kW	Bus bars with single holes for 3/8" bolts for each terminal (POS. and NEG.)

Table 2–5. Output Terminal Connections

Manufacturer	Low Current	High Current
Panduit	P, PV, or PN series, or equivalent	Standard stranded wire: LCA Series, or equivalent Flexible stranded wire: LCAX Series, or equivalent
Note: *Contact lug manufacturer for recommended crimping tool.*		

Table 2–6. Recommended Lugs

Tool	Manufacturer	Manufacturer P/N
Crimping	Molex	11-01-0197
Extracting	Molex	11-03-0044

Table 2–7. Recommended Sense Connector Tools

2.5 Wire Selection

Care must be taken to properly size all conductors for the input and output of the power supply. This section provides guidance in the selection of wire size.

CAUTION!
Cables with Class B or C stranding should be used. Fine-stranded (flexible) cables should not be used unless crimp-on lugs or ferrules are used that are approved for fine-stranded cables.

2.5.1 Wire Size

The tables below will assist in determining the appropriate wire size for both the input and output connections. Table 2–8 gives *minimum* recommended wire size; these recommendations are for copper wire only. This table is derived from the National Electrical Code, and is for reference only. Local laws and conditions may have different requirements. For higher ratings, wires can be paralleled; refer to the National Electrical Code for guidelines.

Size	Temperature Rating of Copper Conductor			
AWG	60°C	75°C	85°C	90°C
	Types: RUW, T, TW, UF	Types: FEPW, RHW, RH, RUH, THW, THWN, XHHW, USE, ZW	Types: V, MI	Types: TA, TBS, SA, AVB, SIS, FEP, FEPB, RHH, THHN, XHHW
	Current Rating, A(RMS)			
14	20	20	25	25
12	25	25	30	30
10	30	35	40	40
8	40	50	55	55
6	55	65	70	75
4	70	85	95	95
3	85	100	110	110
2	95	115	125	130
1	110	130	145	150
0	125	150	165	170
00	145	175	190	195
000	165	200	215	225
0000	195	230	250	260

Table 2–8. Minimum Wire Size

When determining the optimum cable specification for your power applications, the same engineering rules apply whether at the input or output of an electrical device. Thus, this guide applies equally to the AC input cable and DC output cable for this power supply and application loads.

Power cables must be able to safely carry maximum load current without overheating or causing insulation degradation. It is important to power supply performance to minimize IR (voltage drop) loss within the cable. These losses have a direct effect on the quality of power delivered to and from instruments and corresponding loads.

When specifying wire gauge, consider derating due to operating temperature at the wire location. Wire gauge current capability and insulation performance drops with the increased temperature developed within a cable bundle and with increased environmental temperature. Thus, short cables with generously derated gauge and insulation properties are recommended for power source applications.

Be careful when using published commercial utility wiring codes. These codes are designed for the internal wiring of homes and buildings and accommodate the safety factors of wiring loss, heat, breakdown insulation, aging, etc. However, these codes consider that up to 5% voltage drop is acceptable. Such a loss directly detracts from the quality performance specifications of this SG power supply. Also, consider how the wiring codes apply to bundles of wire within a cable arrangement.

In high performance applications requiring high inrush/ transient currents, additional consideration is required. The cable wire gauge must accommodate peak currents developed at peak voltages, which might be up to ten times the average current values. An underrated wire gauge adds losses, which alter the inrush characteristics of the application and thus the expected performance.

Table 2–9 presents wire resistance and resulting cable voltage drop at maximum rated current, with the wire at 20°C. Copper wire has a temperature coefficient of $\alpha = 0.00393\Omega/°C$ at $t1 = 20°C$, so that at an elevated temperature, t2, the resistance would be $R2 = R1 (1 + \alpha (t2 - t1))$.

Column 1	Column 2	Column 3	Column 4
Size, AWG	**A(RMS)**	**Ohms/100 Ft (One Way)**	**Voltage Drop/100 Ft (Column 2 x Column 3)**
14	20	0.253	5.06
12	25	0.156	3.90
10	30	0.999	3.00
8	40	0.063	2.52
6	55	0.040	2.20
4	70	0.025	1.75
3	85	0.020	1.70
2	95	0.016	1.52
1	110	0.012	1.32
0	125	0.010	1.25
00	145	0.008	1.16
000	165	0.006	0.99
0000	195	0.005	0.98

Table 2–9. Wire Resistance and Voltage Drop, 20°C

2.6 LOAD CONSIDERATIONS

This section provides guidelines for incorporating protective diode networks at the output of the power supply to prevent damage while driving inductive loads or loads having stored energy that could be circulated back to the power supply.

2.6.1 Inductive and Stored-Energy Loads

To prevent damage to the power supply from inductive voltage kickback, connect an anti-parallel diode (rated at greater than the supply's output voltage and current) across the output: Connect the cathode to the positive output and the anode to return.

Where positive load transients, such as back EMF from a motor might occur, or stored energy is present such as a battery, a second blocking diode in series with the output is recommended to protect the power supply.

BLOCKING AND ANTI-PARALLEL DIODES

Ensure that the chosen components are suitably rated for the particular inductance and energy to be dissipated. The Peak Reverse Voltage ratings should be a minimum of 2 times the Power Supply maximum output voltage. The Continuous Forward Current ratings should be a minimum of 1.5 times the power supply maximum output current. A heatsink may be required to dissipate the power caused by flow of current.

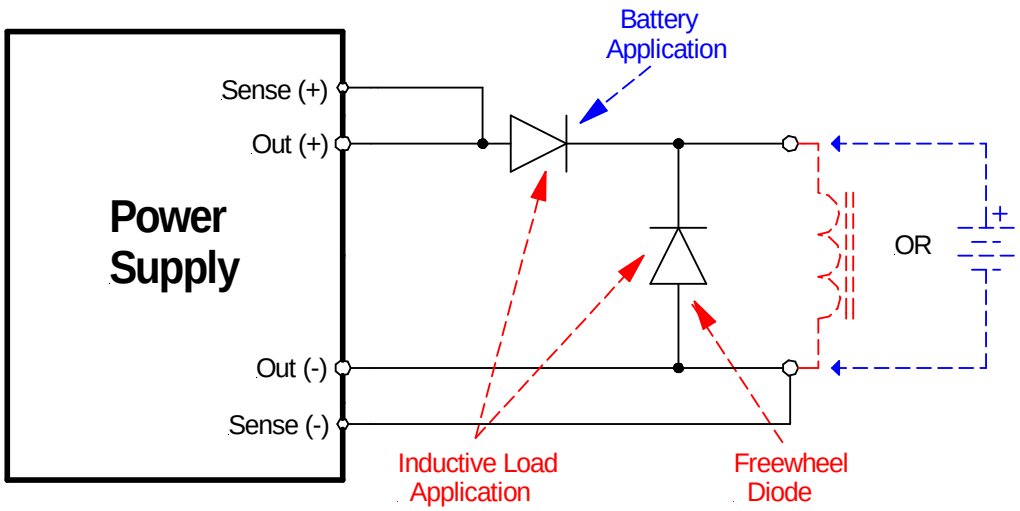


Figure 2-3. Diode Connection

2.7 Outline Drawings

Figure 2-4 through Figure 2-7 show the outlines and overall dimensions for installation of the 3U and 6U models of the SGI Series power supplies. Figure 2-8 through Figure 2-16 show locations of rear panel connectors. Figure 2-17 shows protective covers for the AC input and DC output of the 3U 10V-30V models.

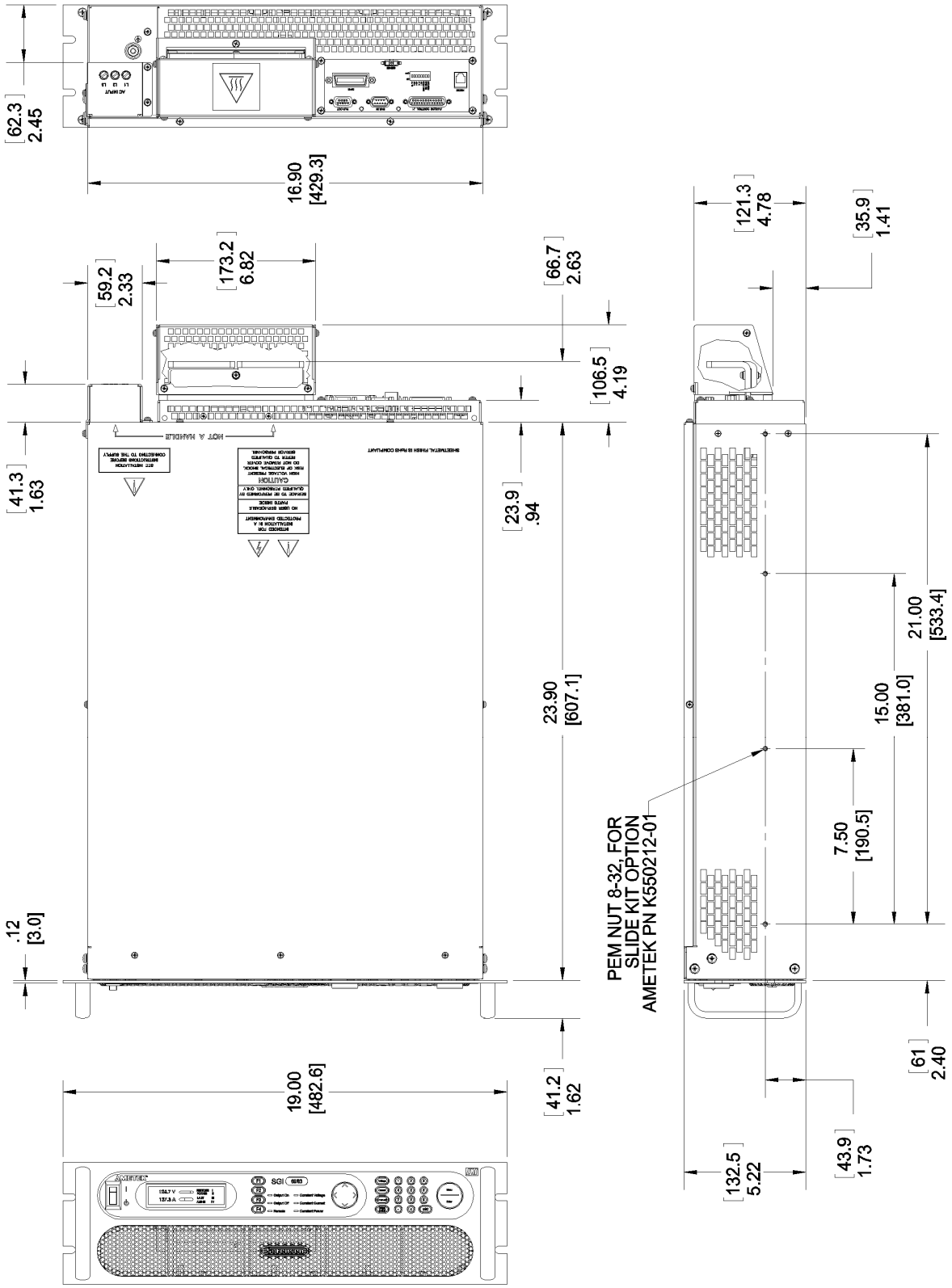


Figure 2-4. Installation Drawing, 3U Models 10V-30V

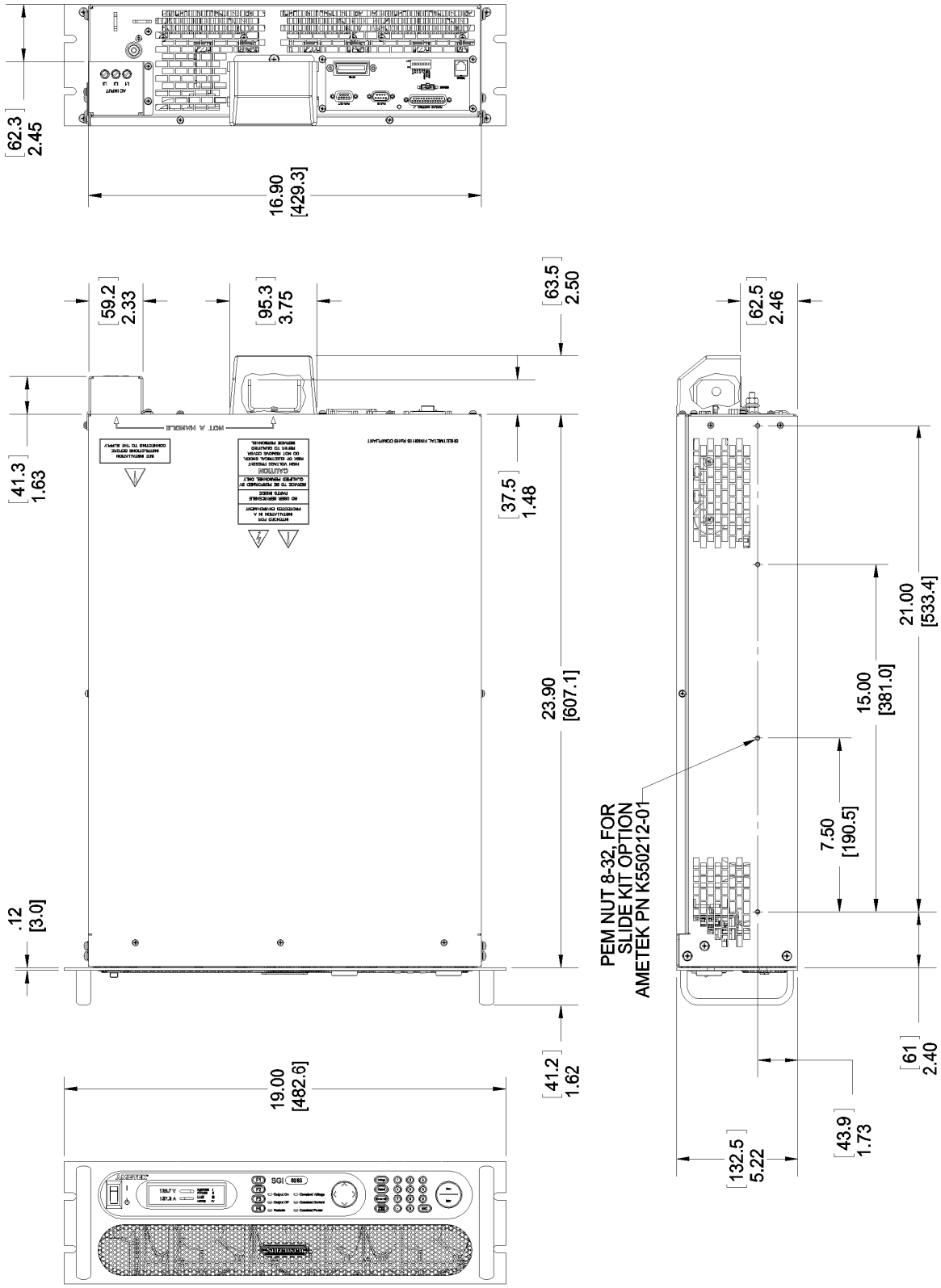


Figure 2-5. Installation Drawing, 3U Models 40V-600V

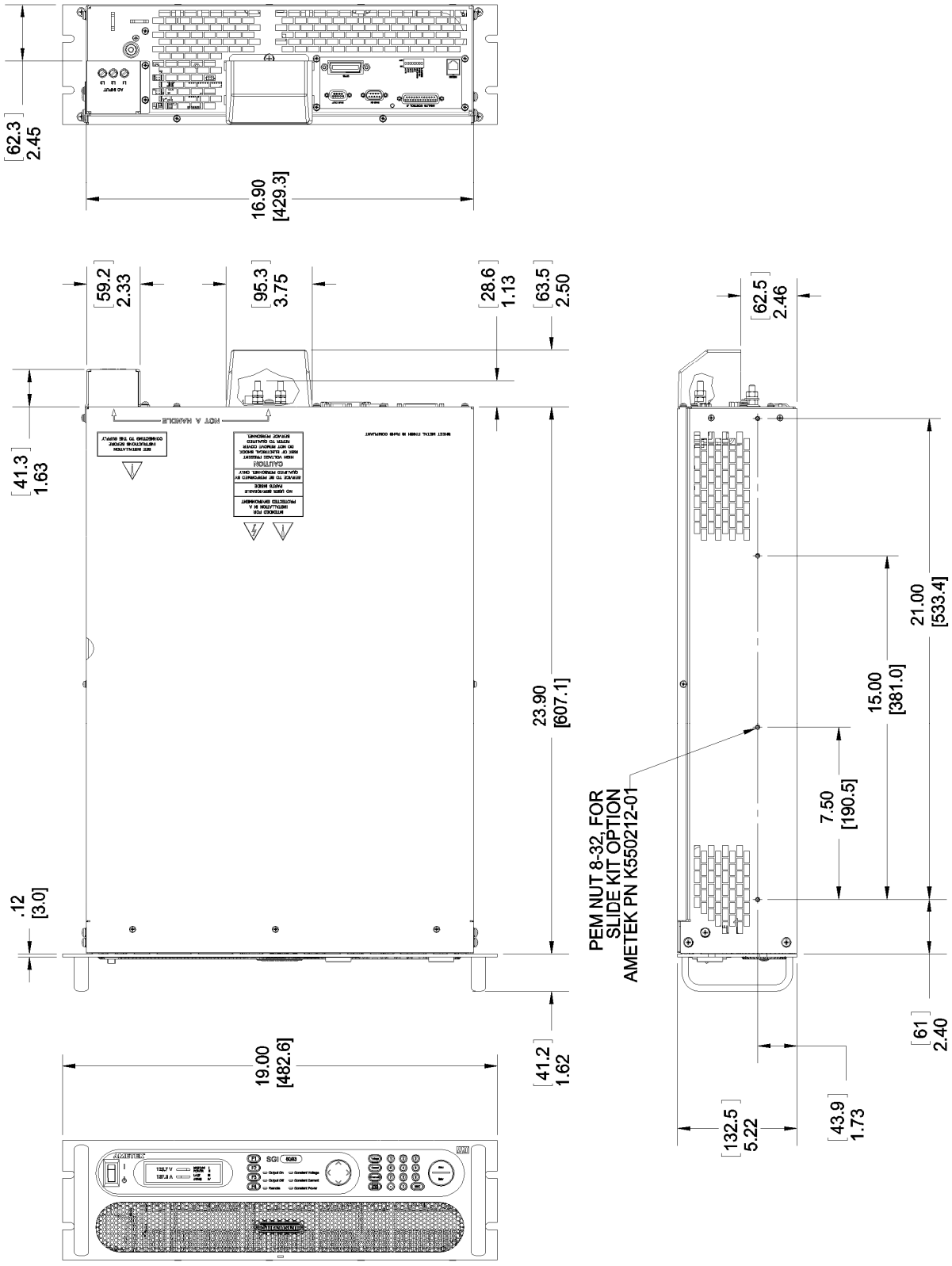


Figure 2-6. Installation Drawing, 3U Models 800V and 1000V

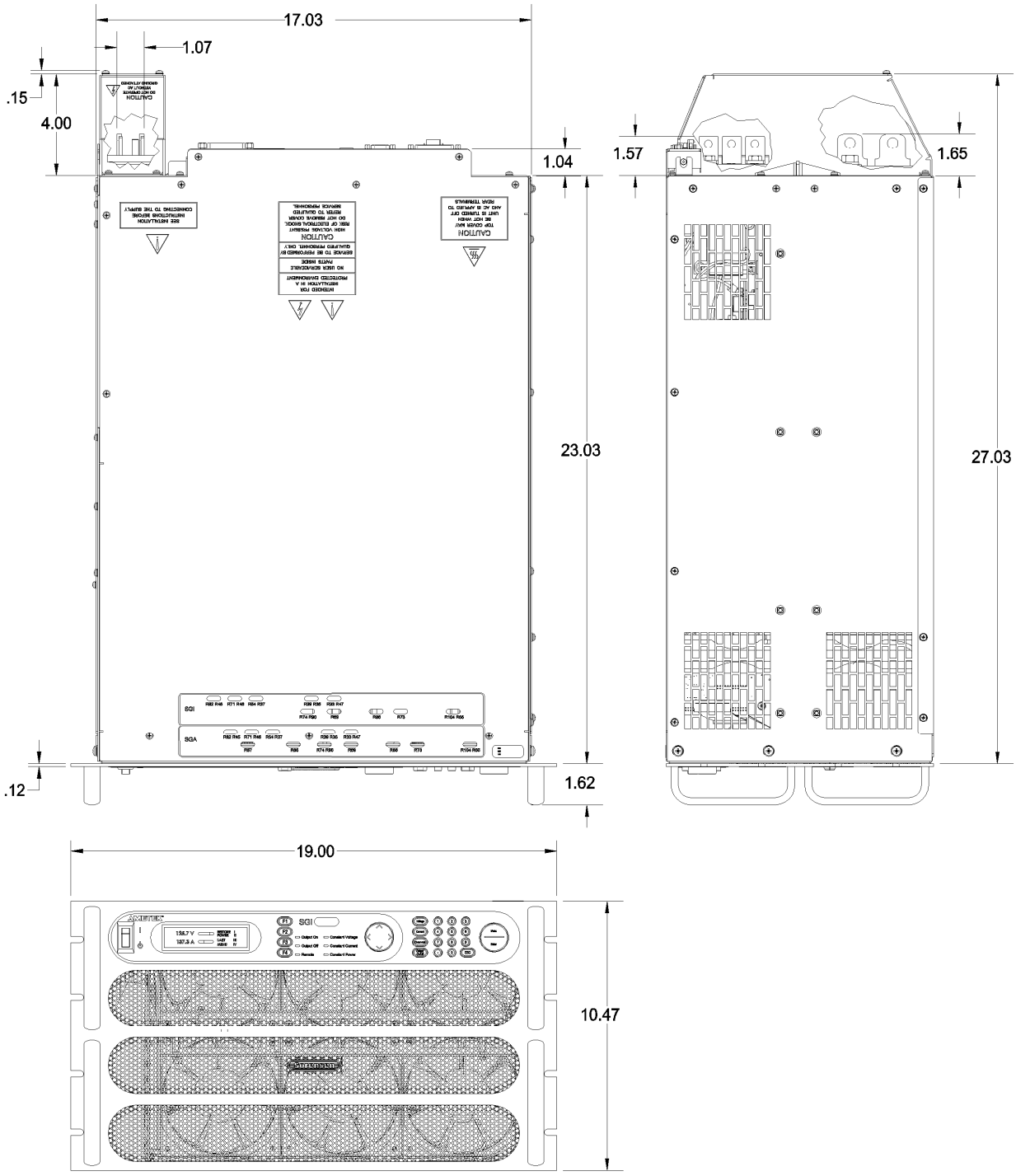


Figure 2-7. Installation Drawing, 6U Models 20kW-30kW

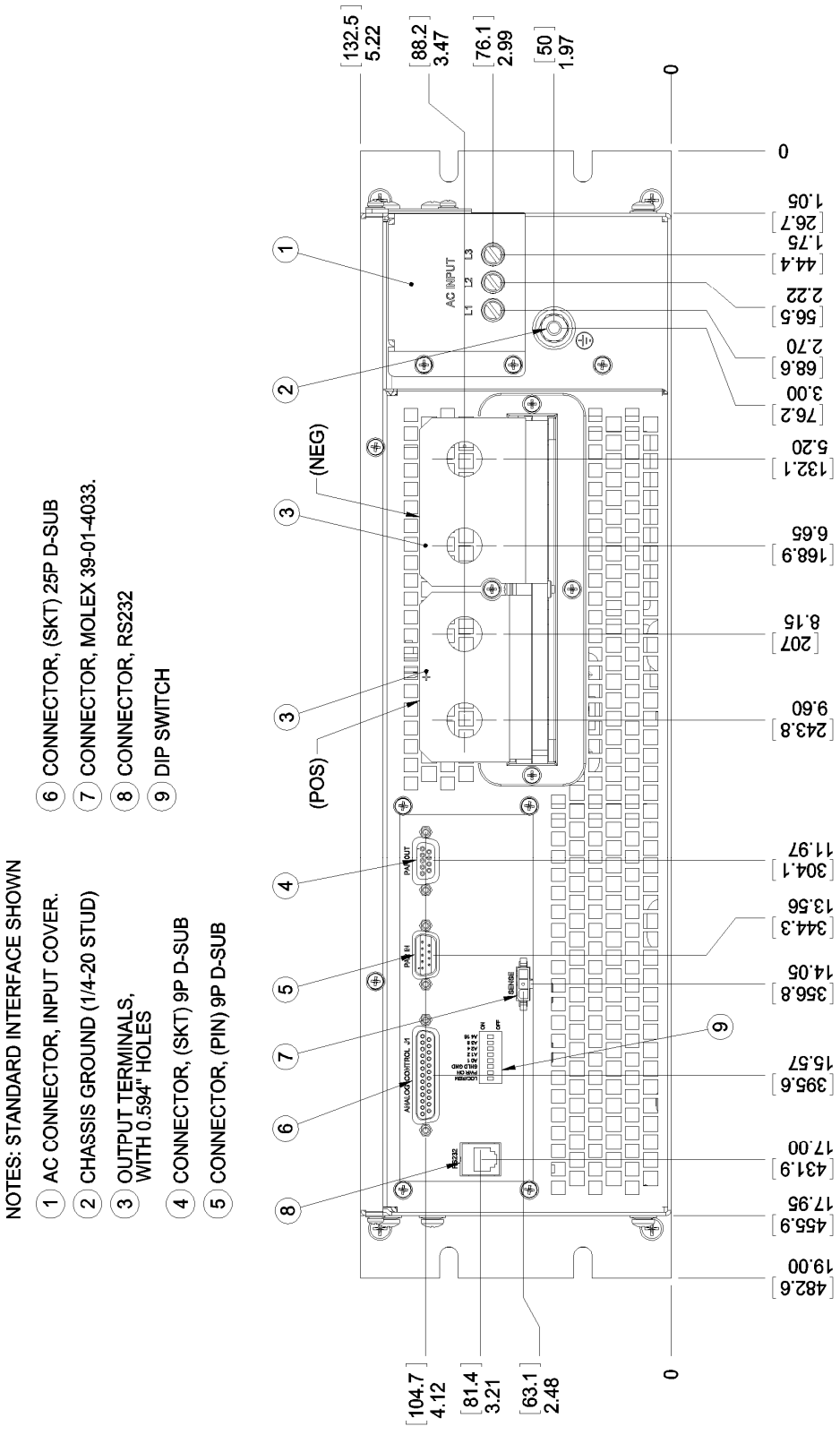


Figure 2-8. Rear Panel, Standard, 3U Models 10V-30V

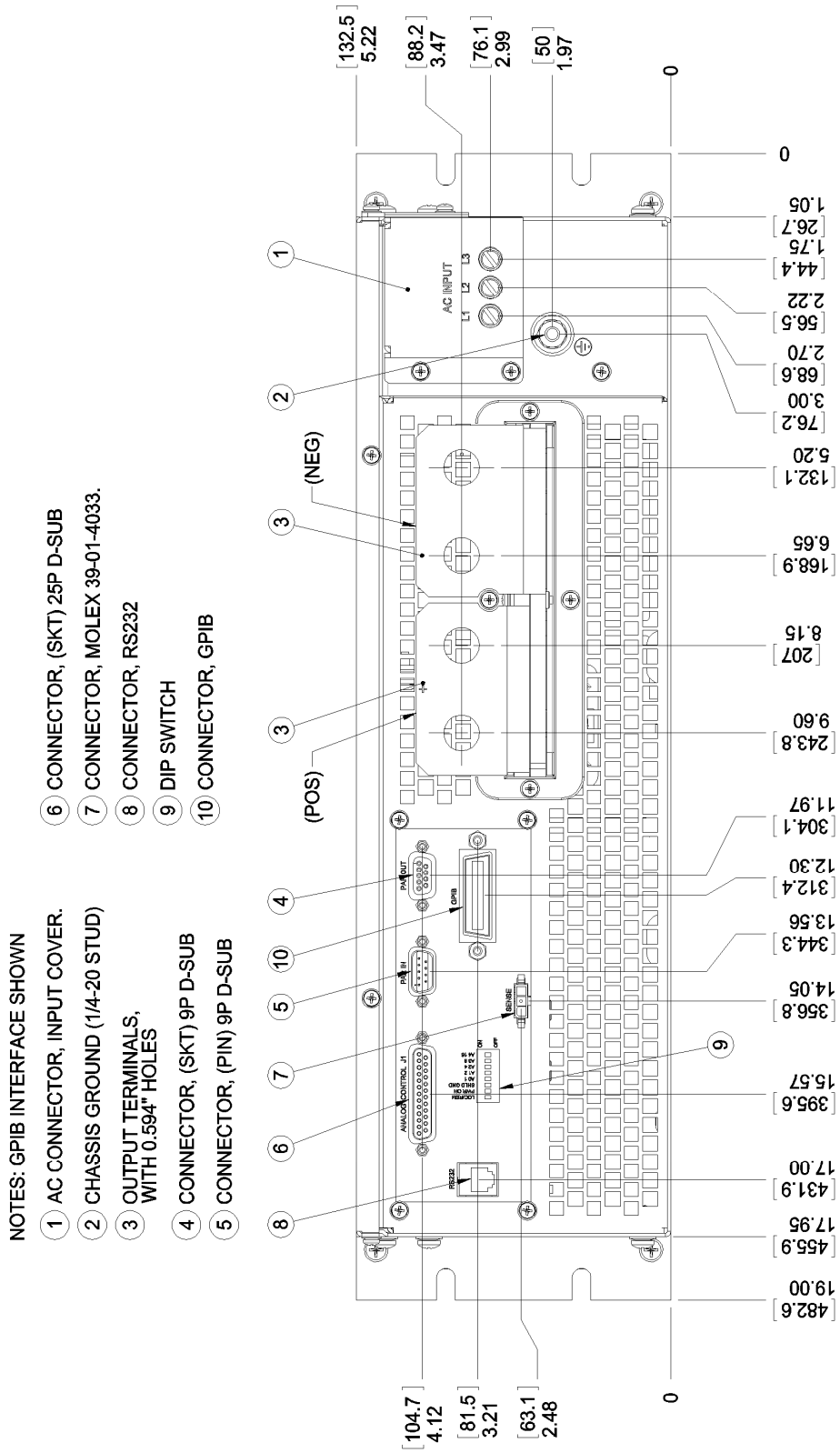


Figure 2-9. Rear Panel, GPIB Option, 3U Models 10V-30V

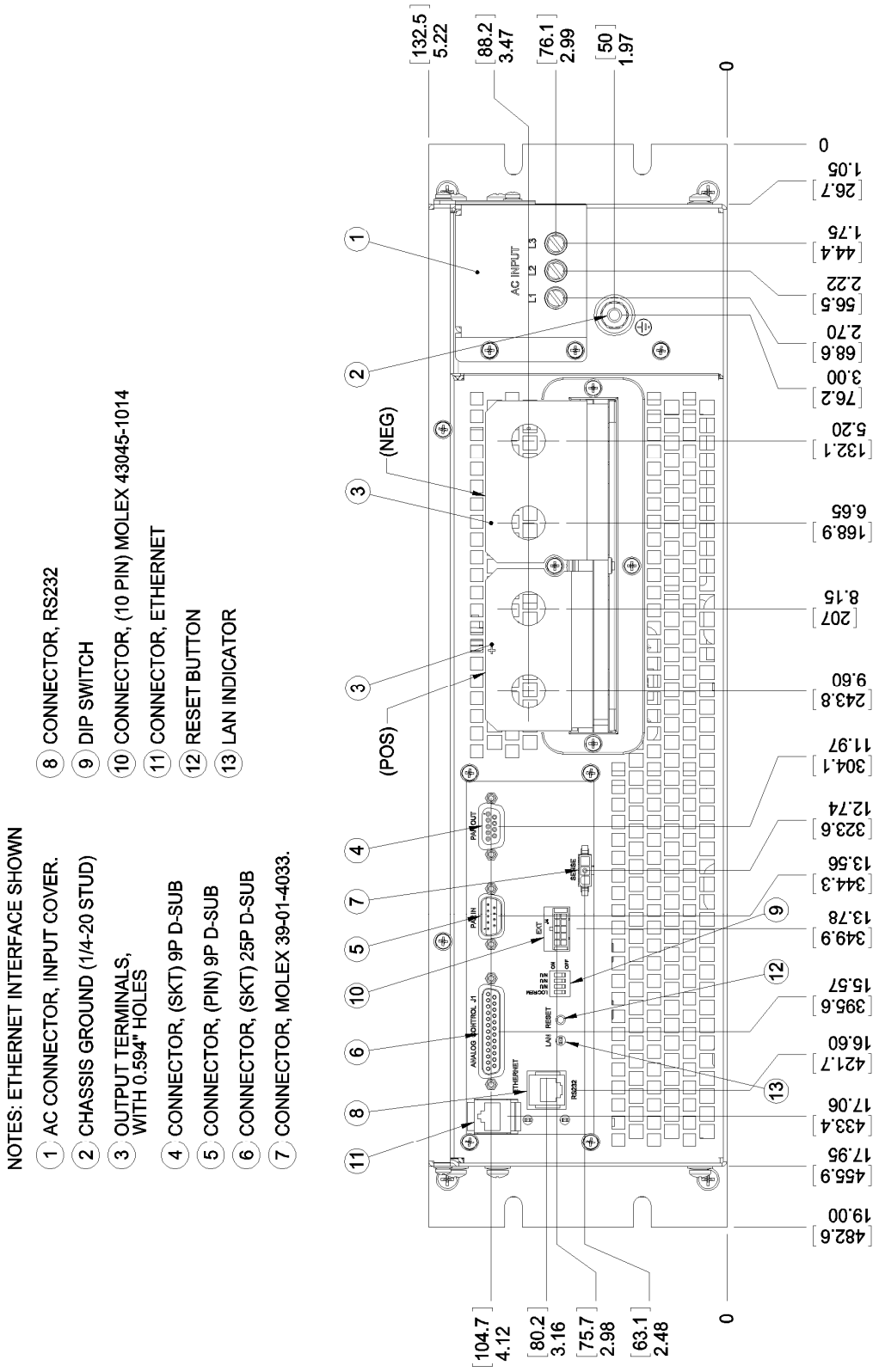


Figure 2-10. Rear Panel, Ethernet Option, 3U Models 10V-30V

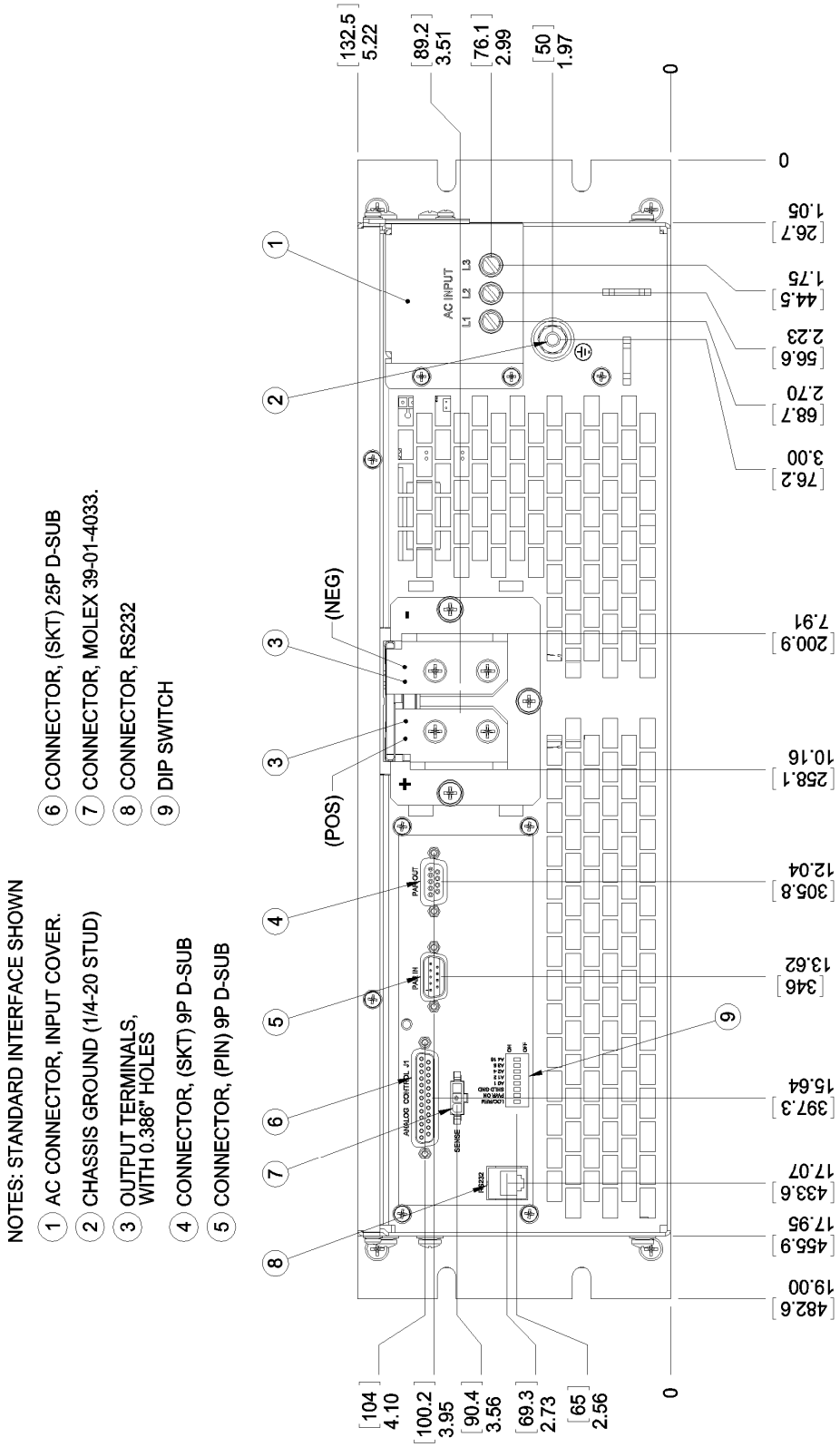


Figure 2-11. Rear Panel, Standard, 3U Models 40V-600V

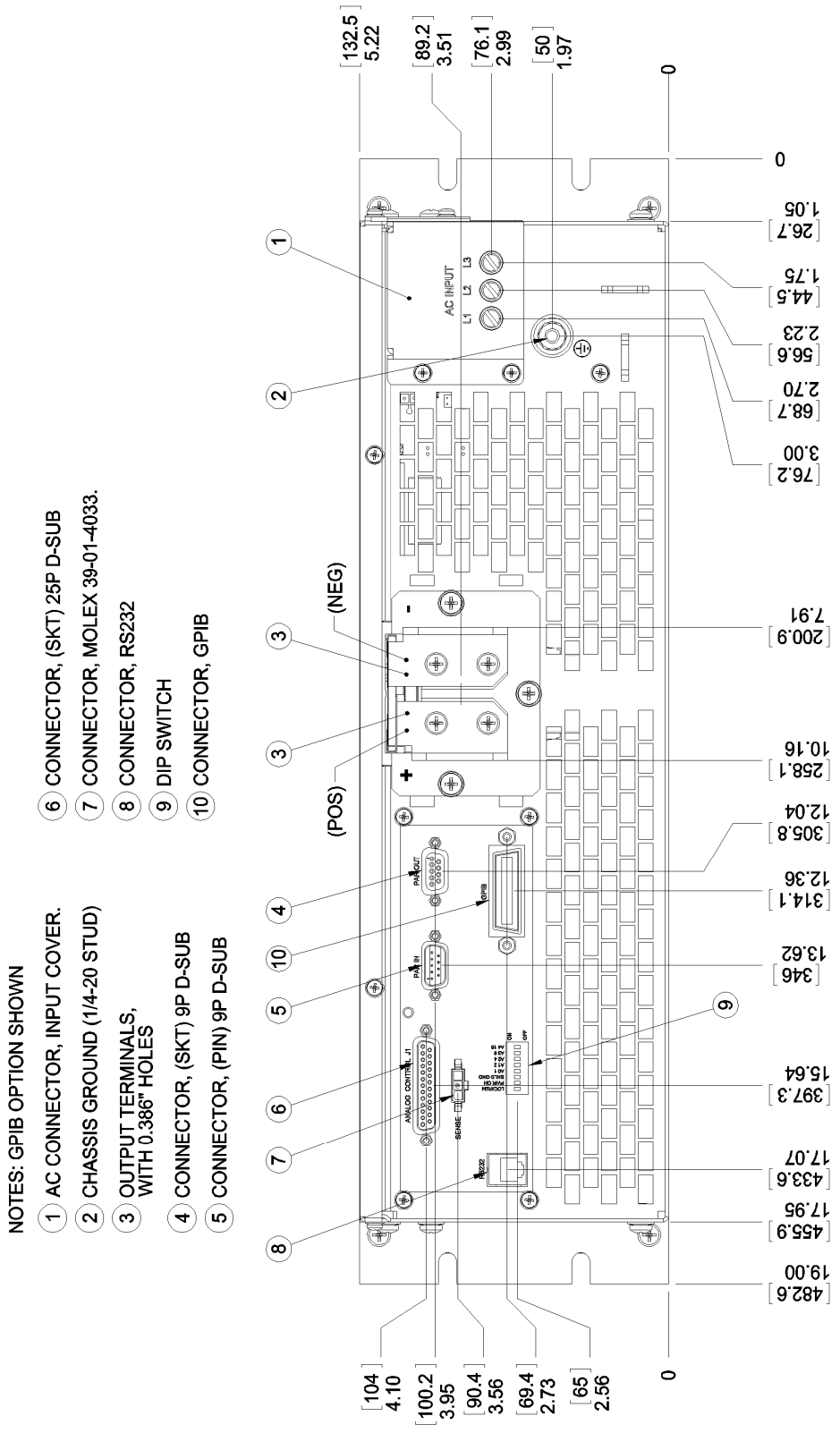


Figure 2-12. Rear Panel, GPIB Option, 3U Models 40V-600V

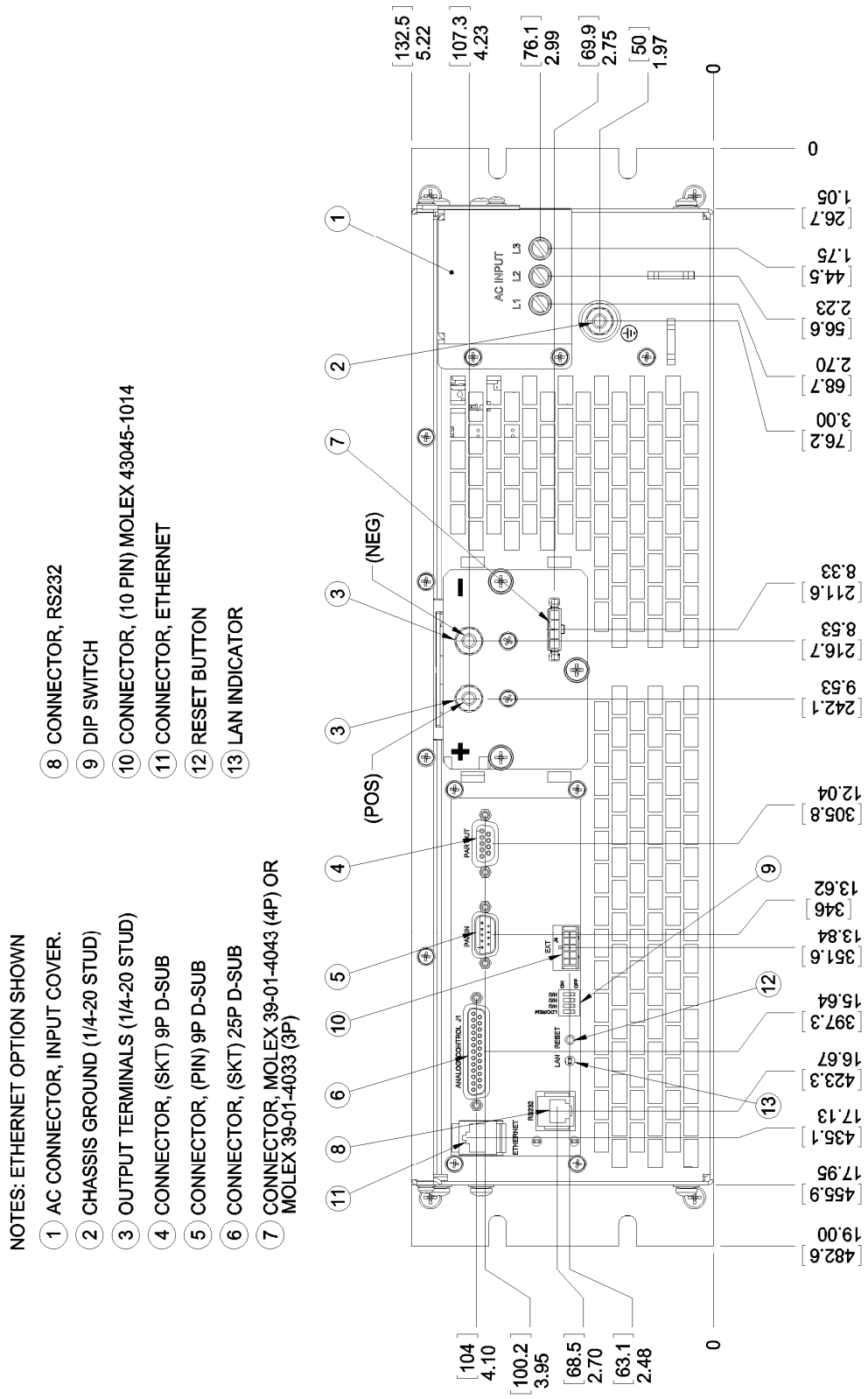


Figure 2-13. Rear Panel, Ethernet Option, 3U Models 800V and 1000V

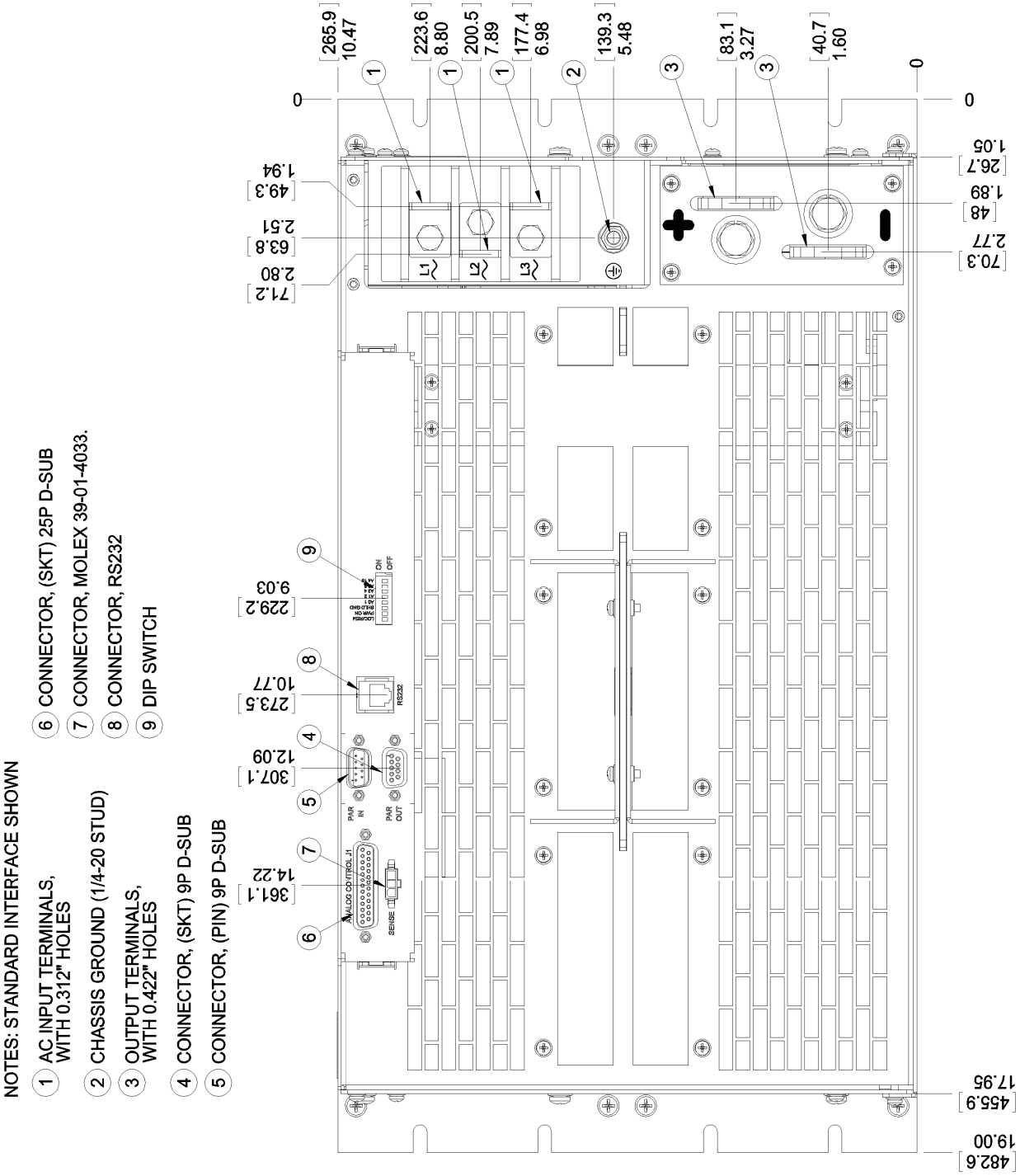


Figure 2-14. Rear Panel, Standard, 6U Models 20kW-30 kW

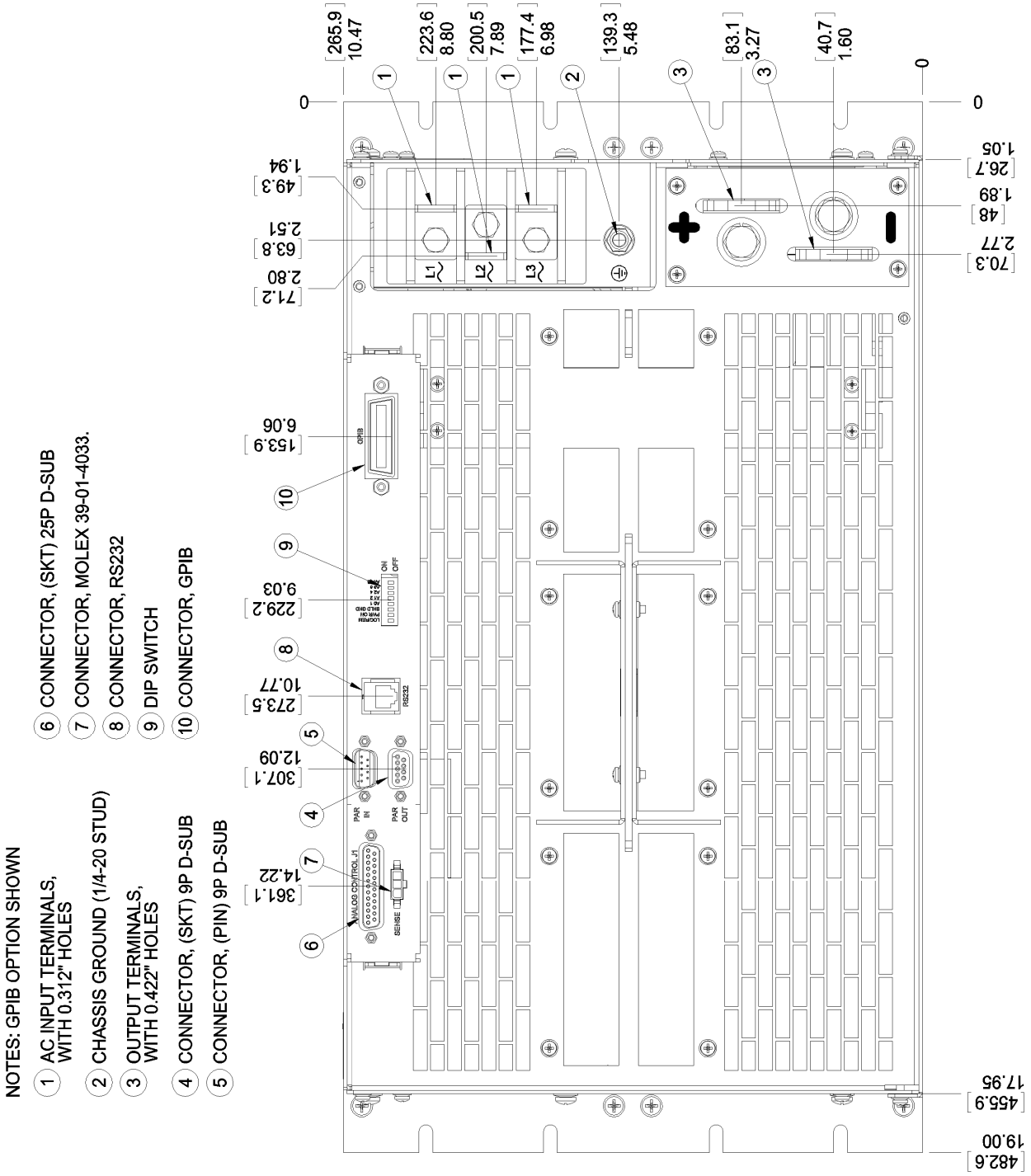


Figure 2-15. Rear Panel, GPIB Option, 6U Models 20kW-30 kW

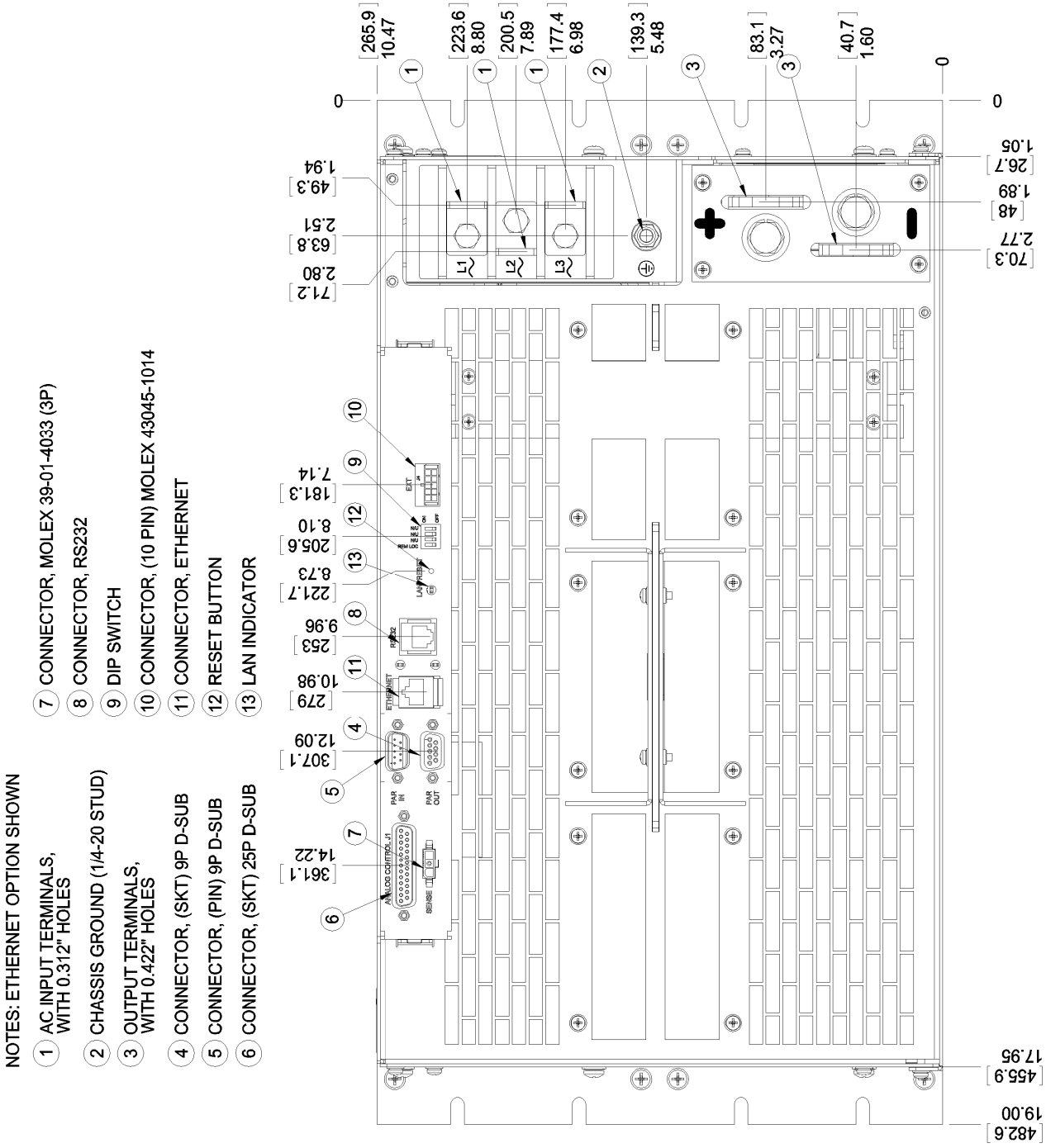


Figure 2-16. Rear Panel, Ethernet Option, 6U Models 20kW-30 kW

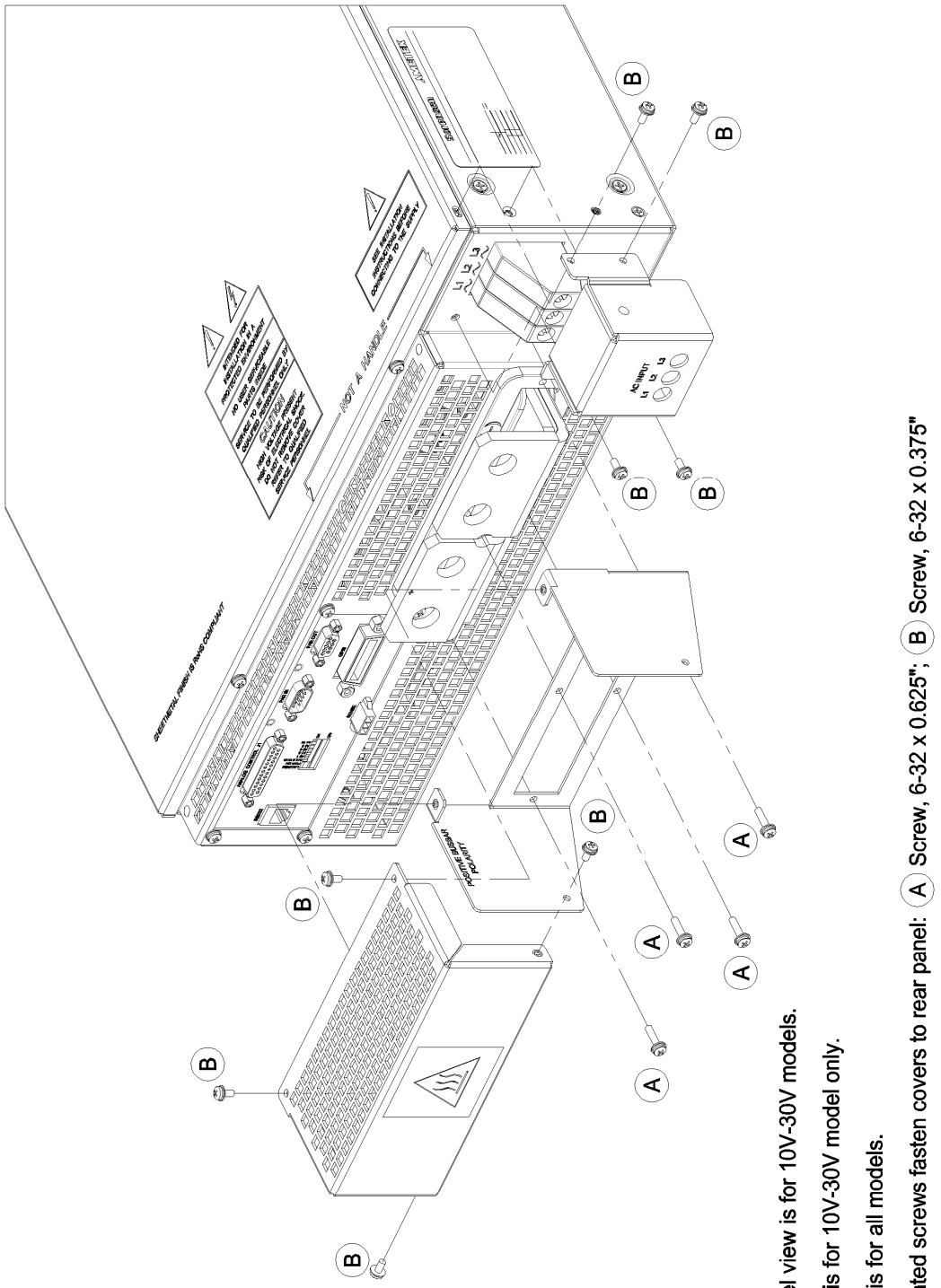

B
A
NOTES:
1 Rear panel view is for 10V-30V models.
2 DC cover is for 10V-30V model only.
3 AC cover is for all models.
4 The indicated screws fasten covers to rear panel: A Screw, 6-32 x 0.625"; B Screw, 6-32 x 0.375"

Figure 2-17. Instructions for Assembly of AC and DC Covers

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SECTION 3
OPERATION

3.1 Introduction

The SGI Series adds powerful functionality and sequence programming to the SG family of DC power supplies. The graphical display, front panel keyboard, and context sensitive keys make setup of the sophisticated functions simple and easy. The following sections provide detailed information on the controls and indicators, programming conventions, and the front panel menu structure of the SGI Series.

3.1.1 Front/Rear Panels

Figure 3-1 shows the front panel of the 3U models; the 6U models have the same controls and indicators. Figure 3-2 through Figure 3-10 show the rear panels of the 3U and 6U models, with their connectors and controls.

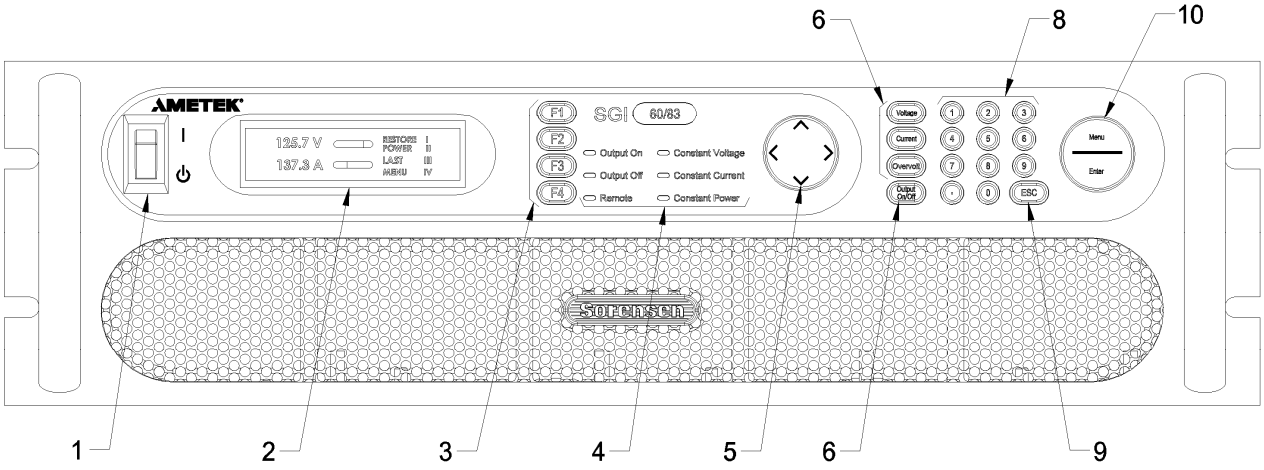


Figure 3-1. Front Panel Controls and Indicators (3U Model Shown)

WARNING!

The power-up factory default state is output enabled, where the output will be energized at the settings of voltage and current.

Item	Reference	Functional Description
1	ON/OFF Switch	Two–position switch turns the power supply on and off. **WARNING!** OFF position does not remove AC input from internal circuits or input terminal blocks. Disconnect external AC input before servicing unit.
2	Front Panel Display	256 x 64 graphic vacuum fluorescent display for menus, settings and functions.
3	Function Keys, F1-F4	Context-sensitive, soft-keys execute commands specified on front panel display by its corresponding label.
4	LED Mode Indicators:	Indicates the mode that is active.
	Output On	Power to output terminals is present.
	Output Off	Power to output terminals is disabled.
	Remote	Supply presently controlled by remote digital interface.
	Constant Voltage	Power supply presently in Constant-Voltage mode.
	Constant Current	Power supply presently in Constant-Current mode.
	Constant Power	Power supply presently in Constant-Power mode.
5	NAVPAD	Navigation Pad navigates between and within screens; also used for increment/decrement control to make live updates; see Section 3.5 Section 3.6.
6	Programming Keys:	Specific function keys, also called hard-coded keys.
	Voltage	Jumps directly to Voltage programming.
	Current	Jumps directly to Current programming.
	Overvolt	Jumps directly to Overvoltage Protection programming.
7	Output On/Off Key	Enables/disables power to the output terminals.
8	Numeric Keys 0-9	Used to enter specific values for editable items.
9	ESC Key (escape)	Cancels numeric input and/or returns to previous menu.
10	Menu/Enter	“Menu” returns to Home Menu Page 1; see Section 3.7.
		“Enter” sets a value that was input via numeric keys.

Table 3–1. Front Panel Controls and Indicators

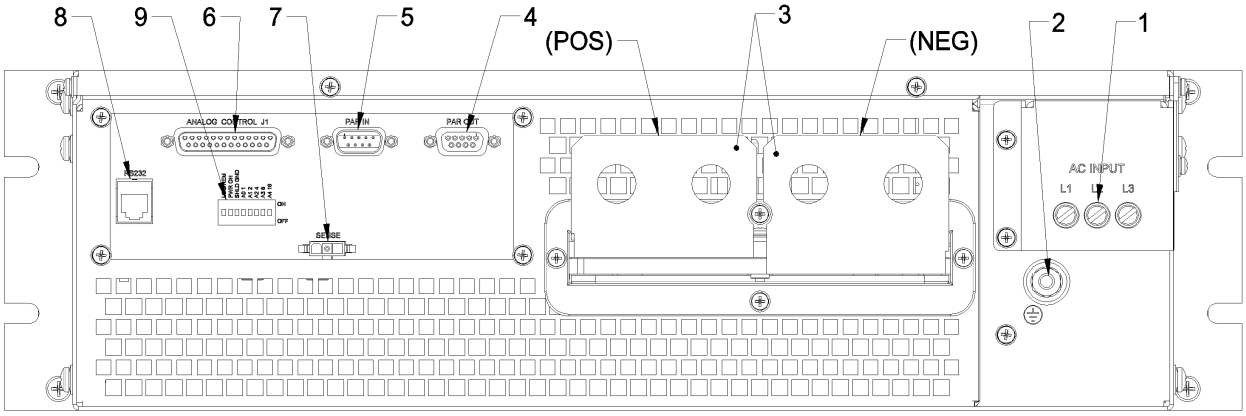


Figure 3-2. Rear Panel Interface, Standard, 3U Models 10V-30V

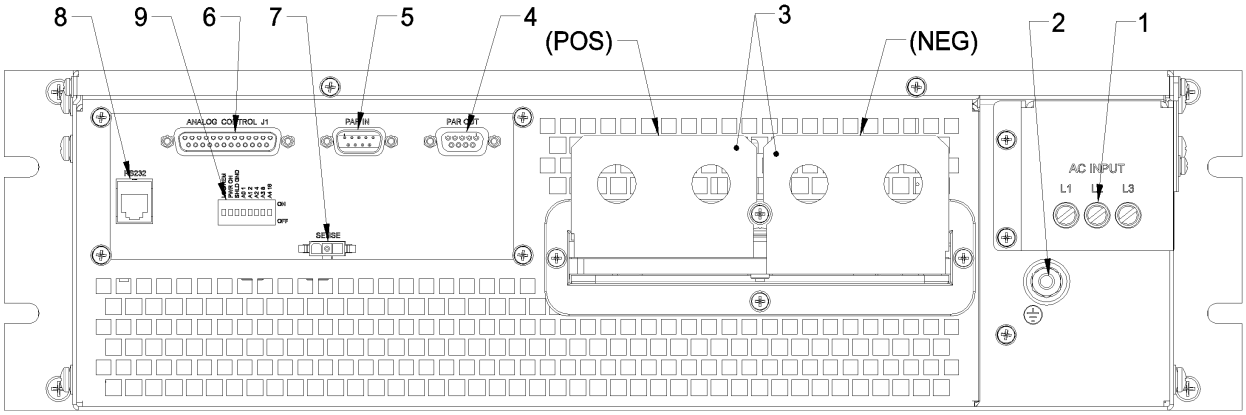


Figure 3-3. Rear Panel Interface, GPIB Option, 3U Models 10V-30V

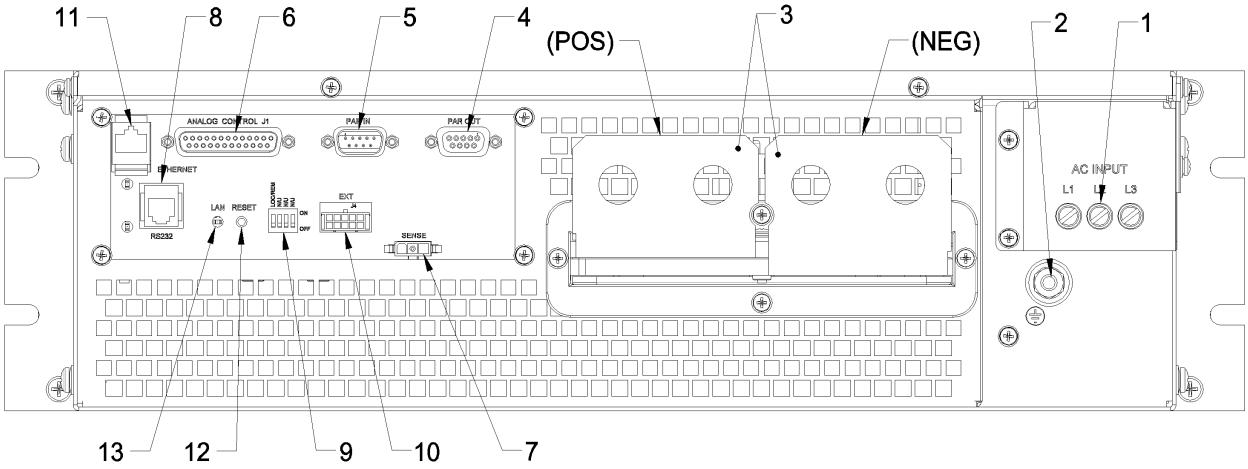


Figure 3-4. Rear Panel Interface, Ethernet Option, 3U Models 10V-30V

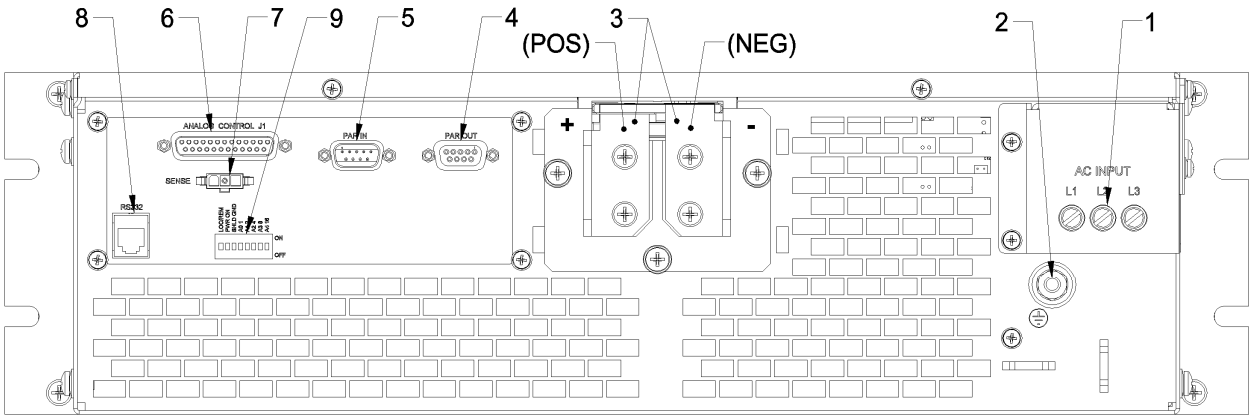


Figure 3-5. Rear Panel Interface, Standard, 3U Models 40V-600V

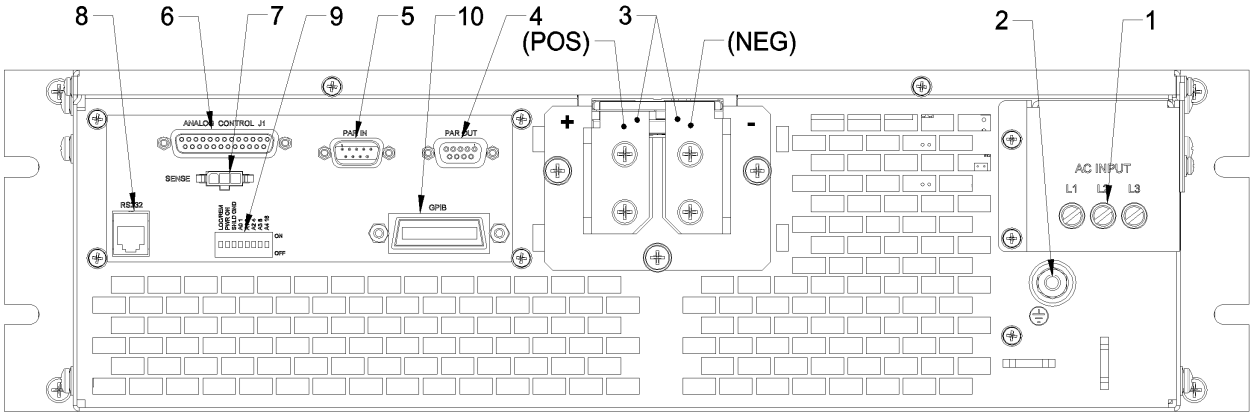


Figure 3-6. Rear Panel Interface, GPIB Option, 3U Models 40V-600V

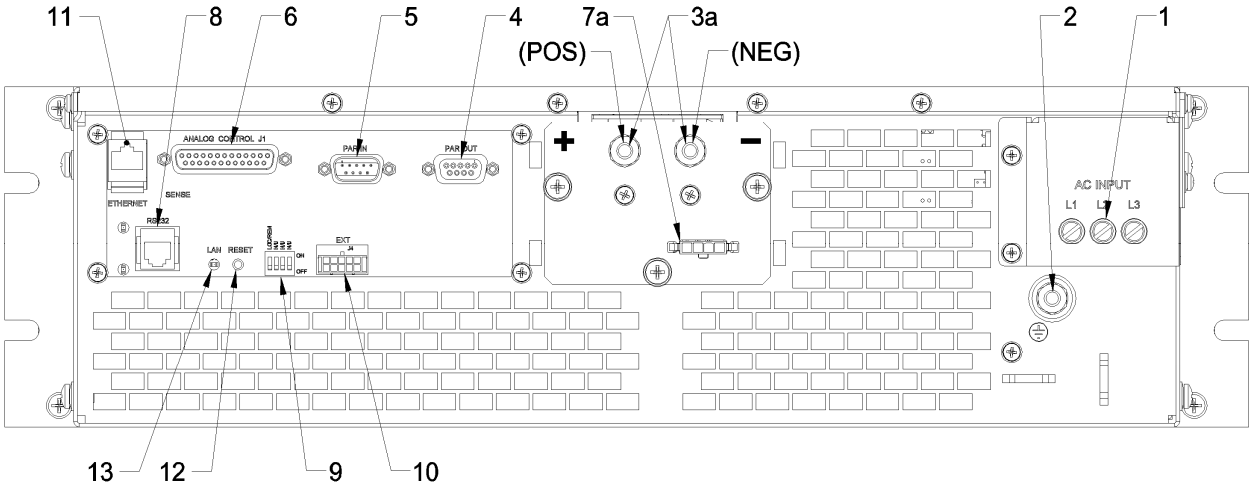


Figure 3-7. Rear Panel Interface, Ethernet Option, 3U Models 800V and 1000V

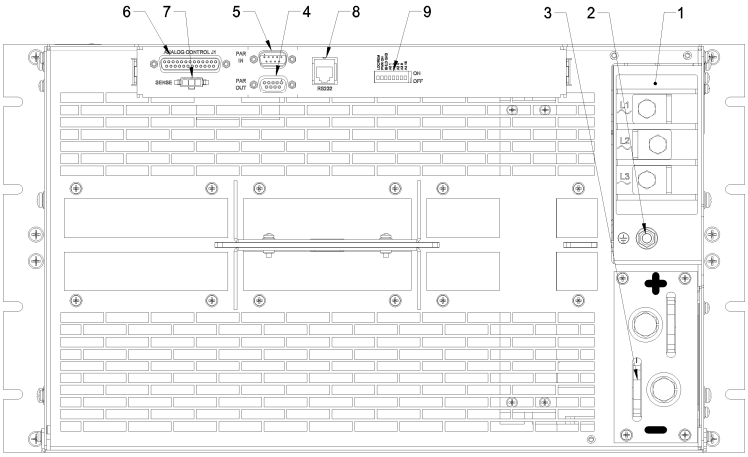


Figure 3-8. Rear Panel Interface, Standard, 6U Models 20kW-30kW

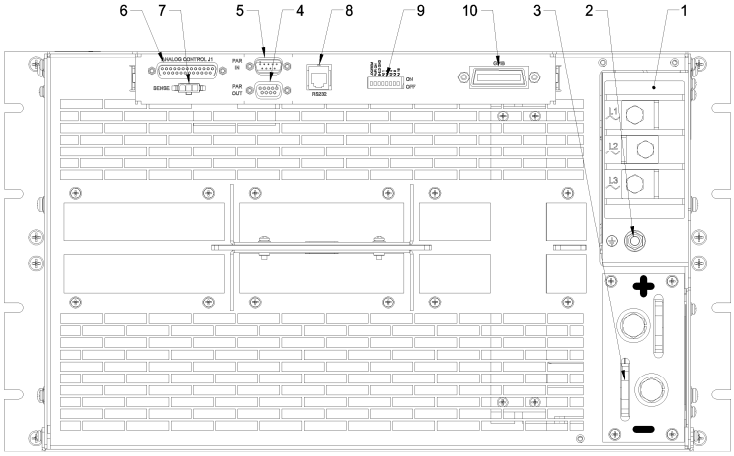


Figure 3-9. Rear Panel Interface, GPIB Option, 6U Models 20kW-30kW

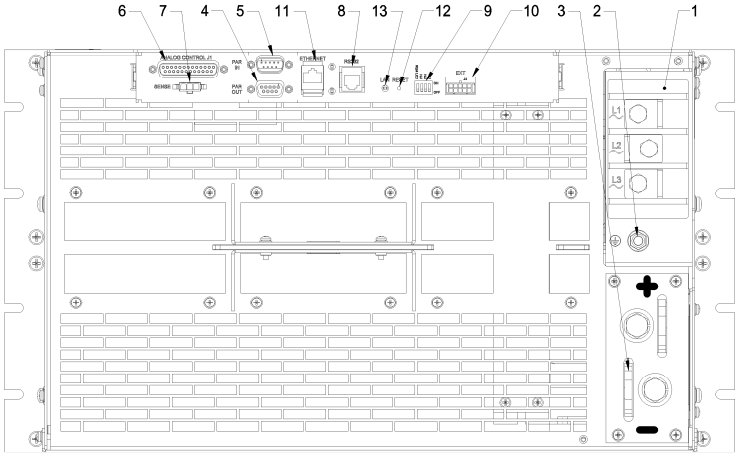


Figure 3-10. Rear Panel Interface, Ethernet Option, 6U Models 20kW-30kW

Item	Reference	Functional Description
1	AC Input Connectors	Connection for 3-phase AC.
2	AC Input Safety Ground	Connection for safety ground wire.
3	DC Output Bus Bars	Positive (+) and negative (–) outputs.
3a	HV DC Output Studs	Positive (+) and negative (–) outputs for 800V and 1000V models only.
4	PAR OUT	Parallel Out connector of master unit for configuring parallel operation of units when connected to Parallel In connector of slave unit; see Section 3.16 .
5	PAR IN	Parallel In connector of slave unit for configuring parallel operation of units when connected to Parallel Out connector of master unit; see Section 3.16.
6	ANALOG CONTROL	Remote Analog Interface connector, J1, for programming and monitoring signals of output, status indication, and remote shutdown signals; see Table 3–5 for individual pin descriptions.
7	SENSE Connector	Input connector, J3, for remote sensing of voltage at the load to compensate for line drop in load cables; see Section 3.14.
7a	HV SENSE Connector	Input connector,J3, for remote sensing of voltage at the load to compensate for line drop in load cables, 800V and 1000V models only; see Section 3.14.
8	RS-232 Connector†	RS-232 connector for remote digital control.
9	Configuration Switch†	Eight-position DIP switch to configure the digital interface of the unit
Refer to Figure 3-2, Figure 3-5, and Figure 3-8**Error! Reference source not found.**. † Refer to the Programming Manual for details on the digital interface.		

Table 3–2. Rear Panel Connectors and Controls, Standard

Item	Reference	Functional Description
1	AC Input Connectors	Connection for 3-phase AC.
2	AC Input Safety Ground	Connection for safety ground wire.
3	DC Output Bus Bars	Positive (+) and negative (–) outputs.
3a	HV DC Output Studs	Positive (+) and negative (–) outputs for 800V and 1000V models only.
4	PAR OUT	Parallel Out connector of master unit for configuring parallel operation of units when connected to Parallel In connector of slave unit; see Section 3.16.
5	PAR IN	Parallel In connector of slave unit for configuring parallel operation of units when connected to Parallel Out connector of master unit; see Section 3.16.
6	ANALOG CONTROL	Remote Analog Interface connector, J1, for programming and monitoring signals of output, status indication, and remote shutdown signals; see Table 3–5 for individual pin descriptions.
7	SENSE Connector	Input connector, J3, for remote sensing of voltage at the load to compensate for line drop in load cables; see Section 3.14.
7a	HV SENSE Connector	Input connector,J3, for remote sensing of voltage at the load to compensate for line drop in load cables, 800V and 1000V models only; see Section 3.14
8	RS-232 Connector†	RS-232 connector for remote digital control.
9	Configuration Switch†	Eight-position DIP switch to configure the digital interface of the unit
10	GPIB Connector†	GPIB connector for remote digital control.
Refer to Figure, Figure 3-6, and Figure 3-9. † Refer to the Programming Manual for details on the digital interface.		

Table 3–3. Rear Panel Connectors and Controls, GPIB Option

Item	Reference	Functional Description
1	AC Input Connectors	Connection for 3-phase AC.
2	AC Input Safety Ground	Connection for safety ground wire.
3	DC Output Bus Bars	Positive (+) and negative (–) outputs.
3a	HV DC Output Studs	Positive (+) and negative (–) outputs for 800V and 1000V models only.
4	PAR OUT	Parallel Out connector of master unit for configuring parallel operation of units when connected to Parallel In connector of slave unit; see Section 3.16.
5	PAR IN	Parallel In connector of slave unit for configuring parallel operation of units when connected to Parallel Out connector of master unit; see Section 3.16.
6	ANALOG CONTROL	Remote Analog Interface connector, J1, for programming and monitoring signals of output, status indication, and remote shutdown signals; see Table 3–5 for individual pin descriptions.
7	SENSE Connector	Input connector, J3, for remote sensing of voltage at the load to compensate for line drop in load cables; see Section 3.14.
7a	HV SENSE Connector	Input connector,J3, for remote sensing of voltage at the load to compensate for line drop in load cables, 800V and 1000V models only; see Section 3.14.
8	RS-232 Connector†	RS-232 connector for remote digital control.
9	Configuration Switch†	Four–position DIP switch to configure the digital interface of the unit
10	External User Connector†	Input/Output connector for external auxiliary digital control signals.
11	ETHERNET Connector†	Ethernet connector for remote digital control.
12	RESET Switch†	Reset switch to return configuration parameters to factory default settings; must be depressed until LAN LED is blinking.
13	LAN†	LED indicator: continuously on indicates Ethernet connection; off indicates no Ethernet connection; blinking indicates Instrument ID.
Refer to Figure 3-4, Figure 3-7, and Figure 3-10. † Refer to the Programming Manual for details on the digital interface.		

Table 3–4. Rear Panel Connectors and Controls, Ethernet Option

3.2 Basic Operation and Output Verification

This section provides an overview and examples of front panel programming, Default Programming menu operation, and initial functional tests for the SGI Series power supply.

The SGI Series power supply is shipped from the factory configured for front panel (local) voltage/current/OVP control, and with the remote sense not connected (default to internal local voltage sensing at chassis output terminals). The remote sense leads must be connected externally by the user to achieved performance specifications. The Analog Control connector is supplied with a mating connector which has the remote output ON/OFF control signals jumpered for ON (Pin-5 shorted to Pin-6) in order to allow the output to be enabled.

WARNING!

The power-up factory default state is output enabled, and the output will be energized with the settings of voltage and current at zero. At initial power-on a screen is displayed with a warning that the output will be enabled after countdown of a 10-second timer; during this state, the output Voltage and Current are programmed to zero, the Overvoltage Protection (OVP) is set to maximum, and the Output State is **OFF**. After the 10-second timer has elapsed, the Output State is changed to **ON.**

3.2.1 Initial Setup

Before connecting the unit to the AC mains, ensure that the front panel ON/OFF power switch is in the **OFF** position. Check the Analog Control (J1) mating connector on the rear panel to verify that Pins 5 and 6 (Remote Output On/Off) are shorted together. This is the default configuration installed from the factory. This jumper allows the output of the supply to be enabled from the front panel when the Output On/Off button is pressed.

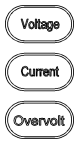
3.2.2 Default Programming Menu

The following subsections describe operation in Constant-Voltage Mode, Constant-Current Mode, and Overvoltage Protection (OVP) using the Default Programming Menu for input of setpoints.

3.2.3 Constant-Voltage Mode Operation

In Constant-Voltage mode operation, the output voltage is regulated at the programmed value while the output current varies with the load requirements. The voltage could be programmed either through the front panel or by the remote analog voltage programming input; see Section 3.11. To verify operation in Constant-Voltage mode, follow these steps:

1. Ensure that there is no load connected to the output.
2. Ensure that the remote sense is connected to the output terminals.
3. Connect a digital voltmeter (DVM) across the rear panel positive and negative output terminals, observing the correct polarity. Make sure the DVM is in the DC voltage mode and the range is adequate to handle the full-scale voltage of the power supply.
4. Apply power to the AC mains input, and turn on the power supply.
5. If the default power-on state had previously been configured to be OFF, when the supply reaches the Home menu Page 1, enable the output by pressing “Output On/Off”.
6. Enter the Default Programming menu by pressing either of the voltage, current or overvoltage front panel keys:



7. Program the Current to 10% of rated output (this programs the current above zero to enable supplying output current while in the constant-voltage mode). See Section 3.8.1 for more details on programming.
8. Navigate to Voltage programming. With the Editing Arrow adjacent to “Set Volt”, press and hold the NavPad up arrow and observe both the front panel voltage display and the output of the DVM begin to accelerate up. The output voltage should increase from 0 V to the maximum rated voltage of the supply. The front panel display and DVM readings should track within the accuracies of the meter and the front panel display.
9. Verify the front panel Constant Voltage Mode indicator is on.
10. Program the Voltage and Current back to zero.
11. Turn the power supply off.
12. If Constant-Voltage mode operation did not function as indicated above, verify the setup and perform the check again. If the function continues to fail, contact the factory for assistance.

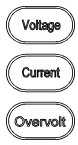
3.2.4 Constant-Current Mode Operation

In Constant-Current mode operation, the output current is regulated at the selected value while the output voltage varies with the load requirements. The current could be programmed either through the front panel or by the remote analog current programming input; see Section 3.10. To verify operation in Constant-Current mode, follow these steps:

1. If the output had been previously energized, allow 5 minutes for the output capacitors to discharge. Connect a high current DC ammeter across the rear panel positive and negative output terminals, observing the correct polarity. Select wire leads of sufficient current carrying capacity and an ammeter range compatible with the units maximum rated output current.

   Note: *Verification that the supply could source rated output current, without measuring the current with an ammeter, but using only the front panel meter, could be performed by shorting the output terminals together.*

2. Turn on the power supply.
3. If the default power-on state had been previously configured to be OFF, when the supply reaches the Home menu Page 1, enable the output by pressing “Output On/Off”.
4. Enter the Default Programming menu by pressing either of the voltage, current, or overvoltage front panel keys:



5. Program the Voltage to 10% of rated output (this programs the voltage above zero to enable supplying output voltage while in the constant-current mode). See Section 3.8.1 for more details on programming.
6. Navigate to Current programming. With the Editing Arrow adjacent to “Set Curr”, press and hold the NavPad up arrow and observe both the front panel current display and the output of the DC ammeter begin to accelerate up. The output current should increase from 0 A to the maximum rated current of the supply. The front panel display and DC ammeter readings should track within the accuracies of the meter and the front panel display.
7. Verify the front panel Constant Current Mode indicator is on.
8. Program the Voltage and Current back to zero.
9. Turn the power supply off.
10. Allow 5 minutes for the output capacitors to discharge and disconnect the ammeter or short from the output terminals.

11. If Constant-Current mode operation did not function as indicated above, verify the setup and perform the check again. If the function continues to fail, contact the factory for assistance.

3.2.5 Overvoltage Protection

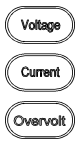
The Overvoltage Protection (OVP) function allows the supply to shutdown the output, if it were to exceed a preset voltage. This may be used to protect sensitive circuits or loads from damage caused by an excessive voltage on the output of the supply. The Overvoltage Protection (OVP) could be programmed either through the front panel or by the remote analog OVP programming input; see Section 3.12. To verify OVP operation, follow these steps:

1. Make sure there is nothing connected across the output terminals.

2. Turn on the power supply.

3. if the default power-on state had been previously configured to be OFF, when the supply reaches the Home Menu Page 1, enable the output by pressing “Output On/Off”.

4. Enter the Default Programming menu by pressing either of the voltage, current, or overvoltage front panel keys:



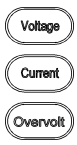
5. Program the Current to 10% of rated output (this programs the current above zero to enable supplying output current while in the constant-voltage mode). See Section 3.8.1 for more details on programming.

6. Navigate to OVP (Overvoltage) programming. The factory default setting is approximately 110% of the maximum rated output of the supply. With the Editing Arrow adjacent to “Set OVP”, press and hold the NavPad **down** arrow and observe the front panel voltage display accelerate down. Release the NavPad **down** arrow when the OVP is programmed to about 80-90% of the maximum rated output voltage value.

7. Navigate to Voltage programming. With the Editing Arrow adjacent to “Set Volt”, press and hold the NavPad **up** arrow and observe the front panel voltage display accelerate up. When the output voltage exceeds the OVP trip point the OVP Warning screen will be display with the voltage level reached at OVP trip. The Output State will be programmed to **OFF**, and the voltage, current, and OVP settings will retain their previous settings.

8. Press (F4) and the fault screen will clear after 4 seconds. The Home Menu Page 1 will be displayed, and the output will remain disabled.

9. Enter the Default Programming menu by pressing either the voltage, current, or overvoltage front panel keys:



10. Program the OVP setting as appropriate for the application as shown above. If OVP will not be used, then “OVP set” programming may be set at maximum, approximately 110% of the rated output voltage of the supply.

11. If OVP mode did not function as indicated above, verify the setup and perform the check again. If the function continues to fail, contact the factory for assistance.

3.3 Initial Start-Up Displays

Upon initial start-up of unit, the following screens are displayed in sequence, after initial splash screens which show manufacturer's information:

LAST CAL DATE

Displays for seven seconds, showing date that the unit was last calibrated. See *SG Series* Programming Manual, P/N M550129-03, for calibration information and how to update "Last Cal Date."

OUTPUT-ENABLED WARNING

Indicates number of seconds left in a 10-second countdown, warning the user that the output will be enabled at the end of the countdown unless the process is aborted by pressing the F1 key on the front panel. Once aborted, the output remains off until the user enables it with the Output On/Off key: refer to Section 3-1. This warning appears only if the unit is both in Local mode *and* was last set and saved to enable the output at its next start-up. See Section 3.8.2 for changing and saving the Power On (PwrOn) Output settings.

Note: *Factory default setting for Output at start-up is ON, output enabled.*

HOME MENU, PAGE 1

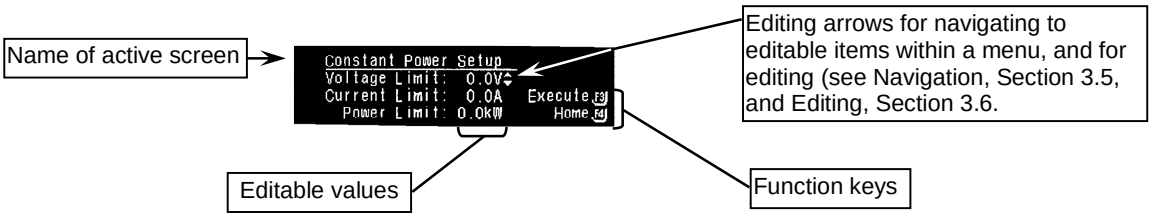
Final screen to display upon initial start-up of the unit; it is from here that the user may access all menu functions. See Menu Map, Section 3.7, for Home

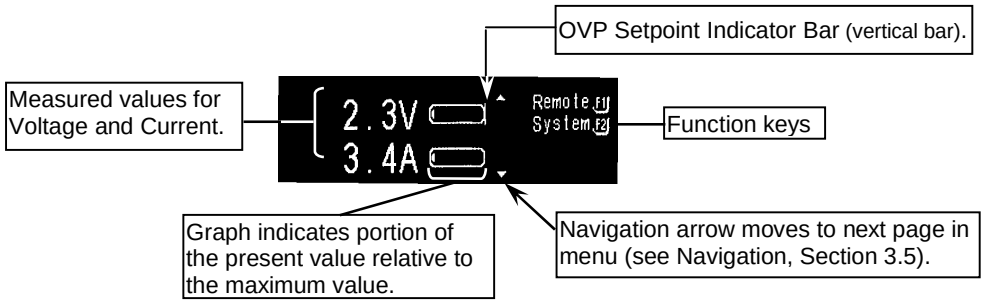
Menu pages 1 through 3 and their submenus. See Functions, Section 3.8, for access and program menu functions.

HOME TIMEOUT

Displays after 30 seconds of idle time in any of the three Home Menu pages; pressing the F4 key on the front panel returns the display to Home Menu Page 1.

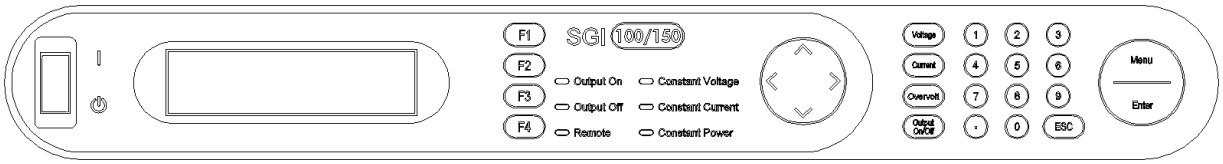
3.4 Display Elements


Name of active screen
Constant Power Setup
Voltage Limit: 0.0V
Current Limit: 0.0A
Power Limit: 0.0kW
Execute F3
Home F4
Editing arrows for navigating to editable items within a menu, and for editing (see Navigation, Section 3.5, and Editing, Section 3.6.
Editable values
Function keys


OVP Setpoint Indicator Bar (vertical bar).
Measured values for Voltage and Current.
2.3V
3.4A
Remote F1
System F2
Function keys
Graph indicates portion of the present value relative to the maximum value.
Navigation arrow moves to next page in menu (see Navigation, Section 3.5).

3.5 Navigation

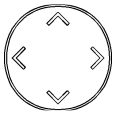
The primary keys used to navigate are: the escape key, ESC, the function keys, F1-F4, the navigation pad, NavPad, the menu and enter key, Menu/Enter and voltage, current, overvoltage protection programming keys, V/I/OVP Prog. Their functions are as follows:



ESC: Probably the most important key to remember, escape works like the back or return button in a browser, bringing the display back one menu level to the previous menu. Continued pressing will eventually return the display to the Home Menu. Escape is not functional in a Fault Screen.

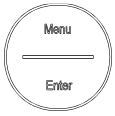
F1-F4: To enter a function menu or execute a function, press the corresponding Function key to the right of the function to be entered or executed. Only those function keys defined within that menu will be operational.

NavPad: Used to move between menu pages and between editable items within a menu

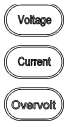


- o If a Navigation Arrow is displayed at the top and/or bottom of a screen, △ ▽ pressing up/down on the NavPad allows the user to move between pages within a menu.
- o If the Editing ⇕ Arrow is displayed, pressing left/right on the NavPad allows the user to move between editable items within a menu. If a screen has only one editable item, left/right arrow has no effect. See Editing, Section 3.6.

Menu/Enter: Pressing "Menu" from any submenu jumps the display directly to the Home Menu, Page 1, except in sequence or power mode; see note below. Pressing "Enter" moves the editing arrow to the next editable item in the menu, similar to the right arrow on the NavPad.



V/I/OVP Prog: Pressing the "Voltage," "Current," or "Overvolt" programming key displays the Default Programming menu with the editing arrow at the corresponding function in that menu - see note below.



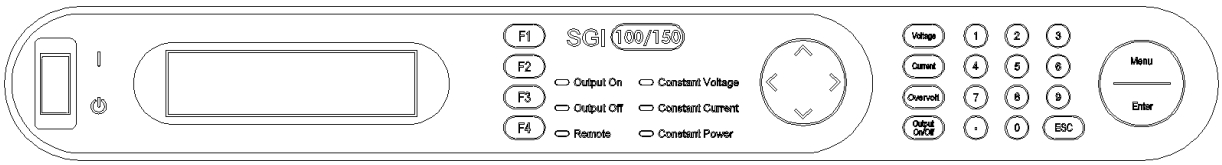
Note: *The "Menu" key and the "Voltage," "Current" and "Overvolt" programming keys do not function while running a sequence, paused in a sequence, in sequence single step mode, or running in power mode.*

3.6 Editing

WARNING!

While Output is enabled, the editable item being programmed Voltage, Current, Overvoltage or Power is “Live Updated”, and takes effect on the output terminals immediately.

The primary keys used to edit are: ESC, F1-F4, NavPad, Menu/Enter and Keypad 0-9. Their functions are as follows:



ESC: In editing, ESC (escape) functions like the escape key on a keyboard. While programming an editable item, the escape key can be used to clear the entered value before it is accepted and takes effect. This leaves the program function setting at the original value before editing began.

F1-F4: Not used to program editable items directly, Function keys may be used to save, recall, cut, past, insert or delete edits made in some menus. These functions will be indicated to the left of the function keys in the specific menus they are used.

NavPad: The NavPad functions as an increment/decrement editing and “Live Update” (Pressing Up/Down). “Live Update” means the value or item displayed due to an edit change from the NavPad, is actively changing the operation of the supply in real time when Output is On. This includes programming editable items as well as scrolling through option lists within a menu.

- Programming editable items: If an Editing Arrow ⇳ is displayed, pressing the NavPad up or down incrementally adjusts the editable item value adjacent to the Editing Arrow by the least significant digit per press in the respective direction. If the NavPad is pressed up or down and held, the selected editable item will accelerate from set point to full-scale or from set point to zero, respectively, within 15 seconds. If the output is enabled, the output terminals will “Live Update” with the programmed changes.
- Scrolling through option lists: Pressing the NavPad up or down incrementally scrolls through the listed items available and “Live Update” selects the item being displayed. Option lists wrap around from top to bottom (pressing NavPad down) and bottom to top (pressing NavPad up).

Menu/Enter: “Enter” is used to accept a value edited or entered using “Keypad 0-9.” When “Enter” is pressed the value edited is programmed into

memory and the Editing Arrow moves to the next editable item. If the output is enabled, the programmed value takes effect on the output terminals immediately after "Enter" is pressed.

- "Menu" is not used to edit.

Keypad 0-9: "Keypad 0-9" is used to program numeric values into editable items using single digit entry. "Enter" must be pressed to program the edited value into memory. The decimal key is for future implementation.

- If the editing arrow is displayed, pressing "Keypad 0-9" will activate the editable item to the left of the Editing Arrow and display the number(s) pressed. As the first number is input, the display begins with the least significant position first, and shifts left as additional numbers are pressed (see Example below). Once the user starts to input a value, the Editing Arrow will begin to blink – a blinking Edit Arrow indicates that the value entered has not been programmed into memory; also, both the NavPad right/left arrows and the NavPad up/down "Live Update" are no longer operational in this condition. The user must either abort (see Section 3.6.1, Aborting an Edit) or press Enter to accept the inputted value.

Example: Programming 50V

Navigate to voltage programming by pressing the "Voltage" programming key. The Default Programming menu is displayed and the Editing Arrow is to the right of the "Set Volt" editable item value. Begin entering the value:

- Press "5" The display "Set Volt" value reads, "0.5V" (Notice the Editing Arrow begins to blink).
- Press "0" The display "Set Volt" value reads, "5.0V"
- Press "0" The display "Set Volt" value reads, "50.0V"
- Press "Enter" The value is programmed into memory. (Notice the Editing Arrow stops blinking and moves automatically to the next editable item. This means the value has been programmed).

3.6.1 Aborting an Edit

"Escape" can be used to cancel an edit before it is accepted. When pressed, the value of the editable item displayed will default to the previous value before editing began. The Editing Arrow does not change position and will no longer be blinking.

Note: *If an invalid or out-of-range value is entered with either the NavPad or "Keypad 0-9", it will be ignored and the user will be alerted through an audible signal.*

3.7 Menu Map

3.7.1 Home Menu

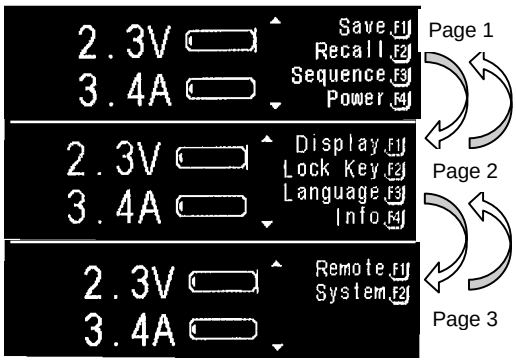
Home Menu is made up of three pages from which the user may navigate to the various function or command screens.

Return to Home Menu Page 1 by pressing Escape as needed, or Menu, except as noted in Section 3.5

ESC

Menu

Enter



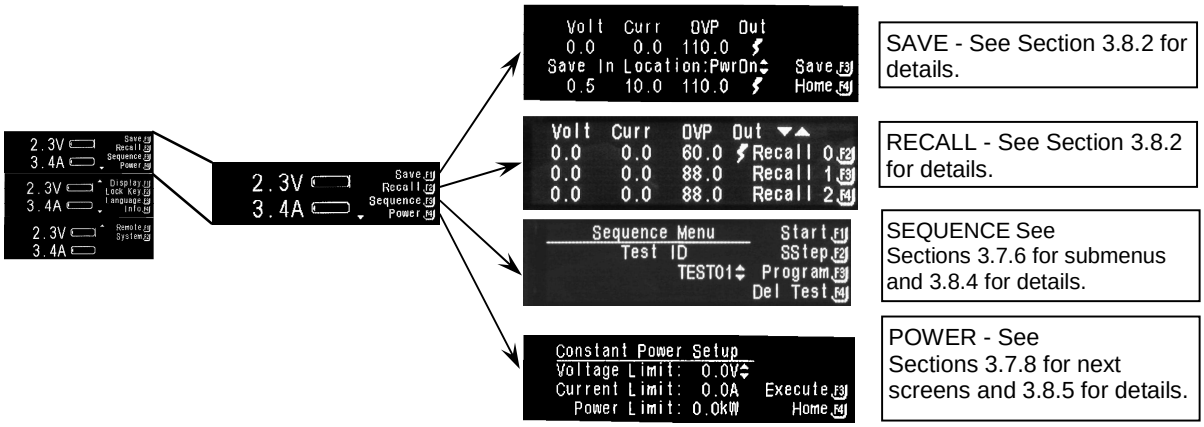
Toggle between pages by pressing up or down on the NavPad. See Section 3.5.

NavPad

3.7.2 Default Programming Menu

Access this menu directly with the hard-code keys, Voltage, Current, or Overvoltage, on the Control Panel. See Section 3.8.1 for details.

3.7.3 Navigating from Home Menu Page 1



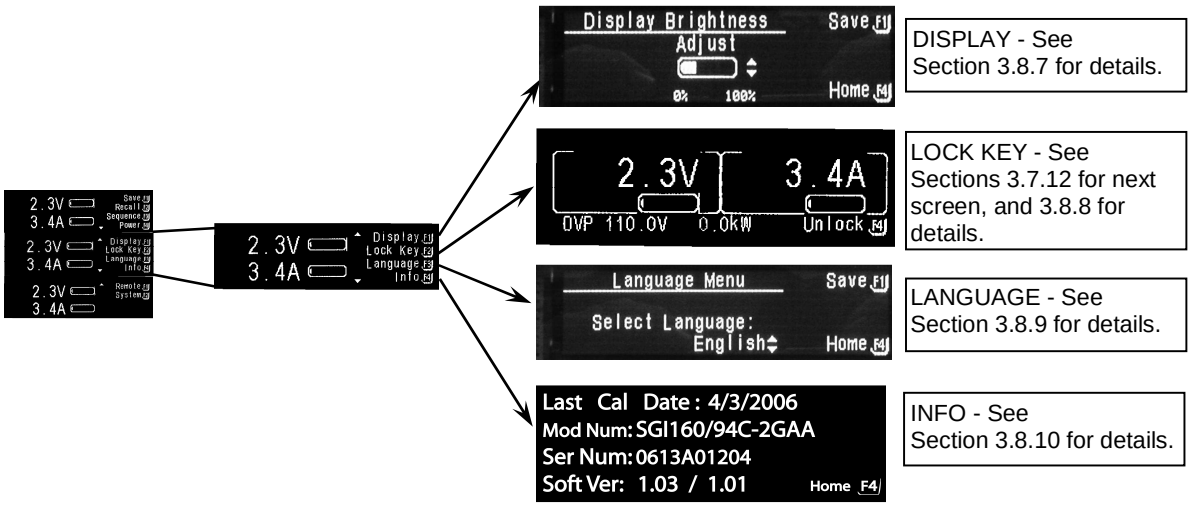
SAVE - See Section 3.8.2 for details.

RECALL - See Section 3.8.2 for details.

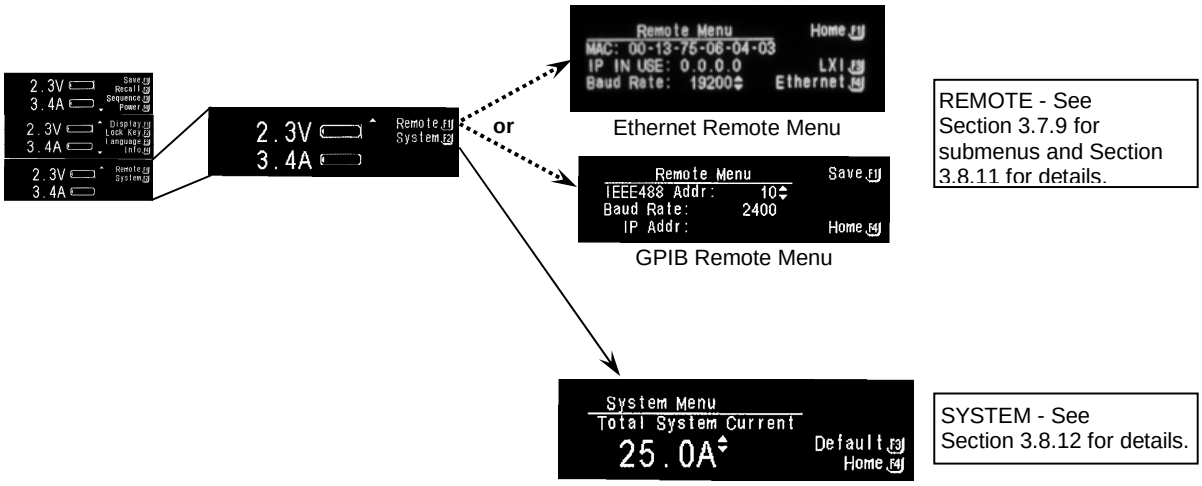
SEQUENCE See Sections 3.7.6 for submenus and 3.8.4 for details.

POWER - See Sections 3.7.8 for next screens and 3.8.5 for details.

3.7.4 Navigating from Home Menu Page 2

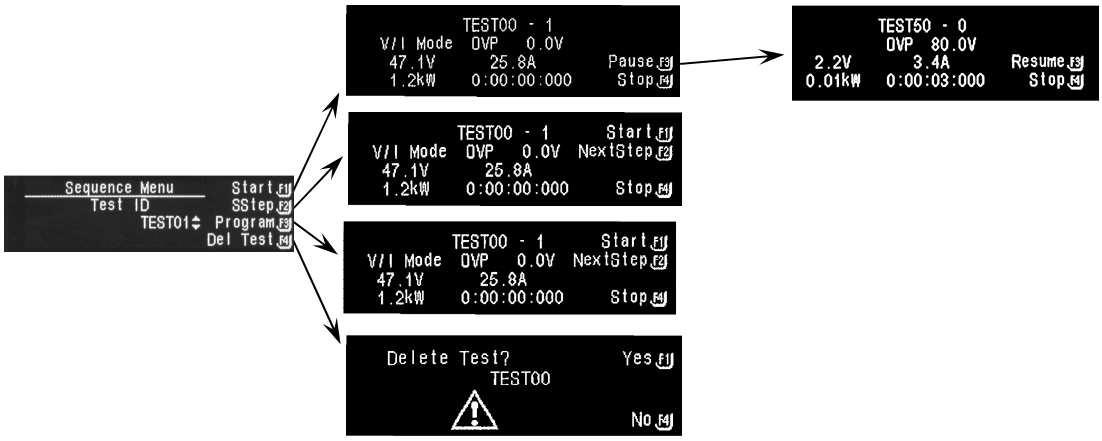


3.7.5 Navigating from Home Menu Page 3



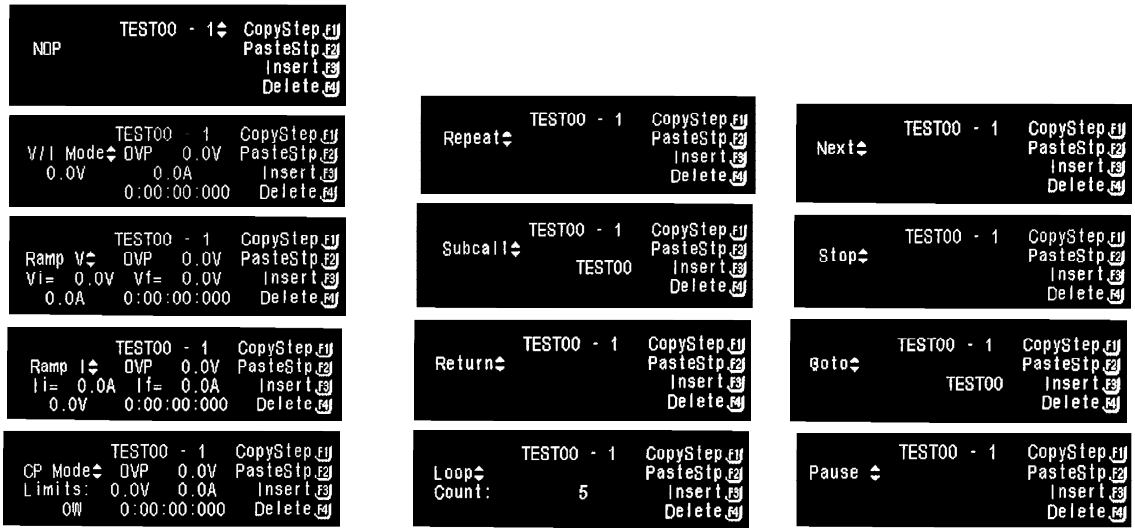
3.7.6 Sequence Menu

Refer to Basic Sequence Operation under Section 3.8.4.



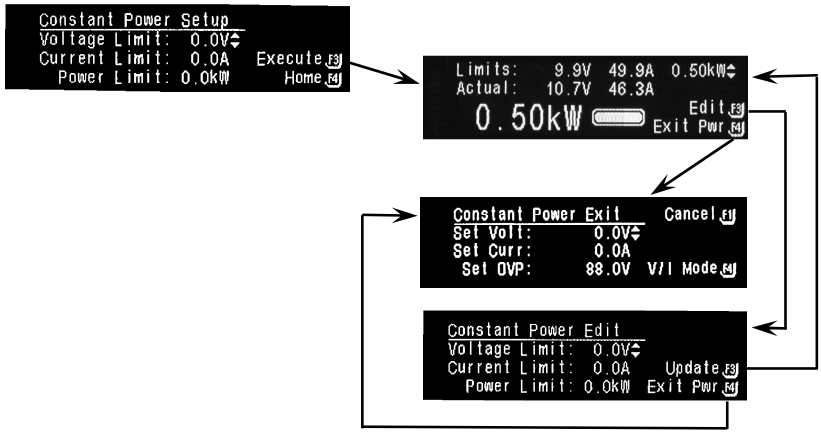
3.7.7 Sequence Programming Operation

The screens in this section show the various operations available for programming a sequence. See details on Step Operations under Section 3.8.4.



3.7.8 Constant-Power Setup Menu

See Section 3.8.5 for details.

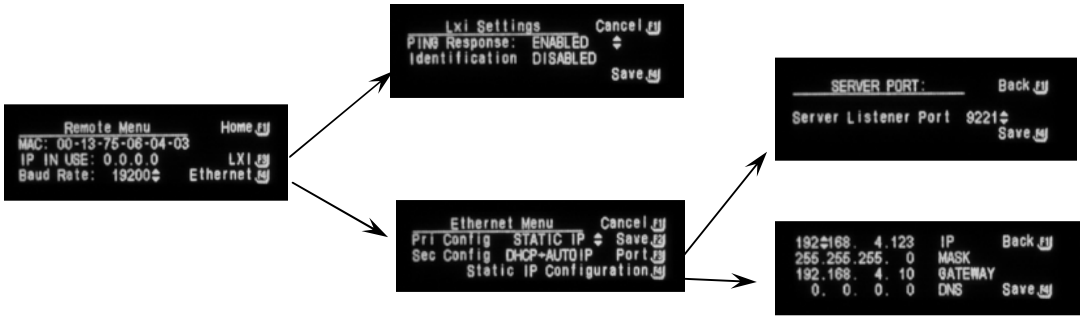


3.7.9 Remote Menu

Remote menu is either GPIB or Ethernet option. The submenus for Ethernet are mapped here; there are no submenus for the GPIB Remote screen (see Section 3.8.11 for details).

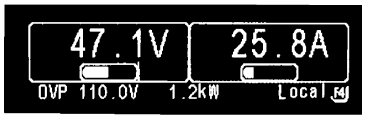
ETHERNET

The Ethernet Remote Menu provides submenus for LXI Settings (F3) and Ethernet Menu (F4). The Ethernet Menu provides submenus for Server Port (F3) and Static IP Configuration (F4). See Section 3.8.11 for details.



3.7.10 Remote Control Screen Examples

Remote screens display when operation is controlled by computer. Pressing F4 from any Remote screen returns operation to Local Mode.



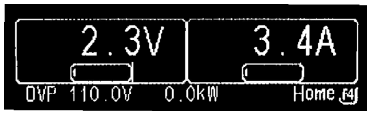
3.7.11 Warning Screens

General hardware failure has occurred. Press F4, Clear Fault, to reset the unit.

Overvoltage Protection was tripped. Press F4, Clear OVP; the unit will reset in 4 seconds.

Displays when a saved setting with Output On is recalled. See Section 3.8.3 for details.

3.7.12 Other Screens



Home Menu Time Out Screen displays after 30-second idle.

Locked Key Screen (From Home Menu Page 2, F2) to unlock press F4

Screen to confirm Unlock control panel keys.

3.8 Programming/Operating Functions

This section describes various programming/operating instructions

3.8.1 Voltage, Current, and Overvoltage Protection Programming

Press Voltage, Current, or Overvoltage key on Control Panel to go directly to the Default Programming Menu. The editing arrow will be displayed next to the corresponding item pressed.

PROGRAMMING VOLTAGE

Go directly to Voltage programming by pressing the voltage key. The Default Programming menu is displayed and the Editing Arrow is to the right of the "Set Volt" editable value. Edit the value by NavPad up/down or by entering the value with "Keypad 0-9". For more details see Section 3.6.

PROGRAMMING CURRENT

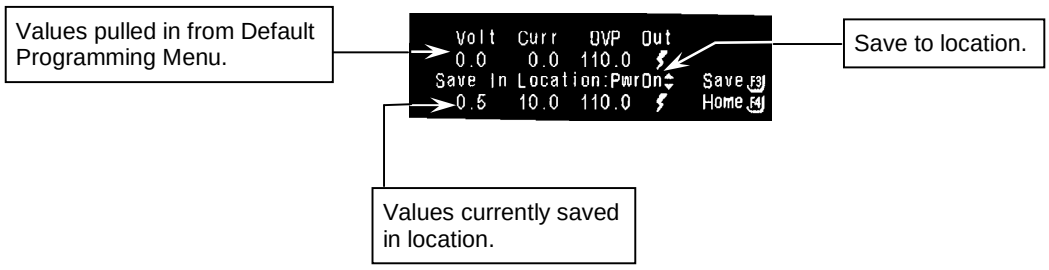
Go directly to Current programming by pressing the current key. The Default Programming menu is displayed and the Editing Arrow is to the right of the "Set Curr" editable value. Edit the value by NavPad up/down or by entering the value with "Keypad 0-9". For more details see Section 3.6.

PROGRAMMING OVERVOLTAGE PROTECTION

Go directly to Overvoltage trip point programming by pressing the overvoltage key. The Default Programming menu is displayed and the Editing Arrow is to the right of the "Set OVP" editable value. Edit the value by NavPad up/down or entering the value with "Keypad 0-9". For more details see Section 3.6.

3.8.2 Save

There are 11 memory locations (PwrOn, 1 through 9, LAST 0/1) into which a programmed output configuration of Voltage, Current, OVP (Overvoltage Protection trip point) and Output Condition can be stored. The LAST 0/1 configuration stores and recovers programmed Voltage, Current, OVP (Overvoltage Protection trip point), Output Condition, and Foldback Protection when power supply is turned off. From Home Menu Page 1 press (F1) to enter the Save menu. Voltage, Current and OVP values programmed in the Default Programming menu will be pulled into the Save menu, top line, upon reaching that menu. In addition, the present output condition, output engaged or output disabled, will be indicated.



EDIT VOLTAGE, CURRENT AND OVP

Toggle between the editable items using the NavPad and edit Voltage, Current and OVP to appropriate values (see Section 3.6 for editing details).

EDIT OUTPUT CONDITION

Pressing NavPad up/down will toggle the output condition indicator **on** ( ) to indicate the output will be enabled and **off** (*blank*) to indicate the output will be disabled.

Note: *Edits will not take effect until the configuration is saved.*

SAVING A CONFIGURATION

With the Editing Arrow adjacent to "Save Location" pressing NavPad up/down allows the user to scroll through the list of memory locations (PWR ON, 1-9, LAST 0/1). Using configurations (PWR ON, and 1-9) Select the appropriate location and press (F3) to save the configuration to that location. The bottom line of the screen will update with the configuration information saved. Using configuration (LAST 0/1) press (F1) to turn ON or (F2) to turn OFF and press (F3) to save configuration. Press (F4), "Escape" or "Menu" key to exit to the Home Menu Page 1 at any time.

Note: *If setting LAST 1. The EEPROM that stores the Last Programmed Values(Voltage, Current, OVP, Output State, Foldback Protection) is limited to 100,000 Write Cycles.*

SAVING TO PWR ON

"PWR ON" is a unique "Save Location." If a configuration is saved to "PWR ON" location, the next time the ON/OFF front panel switch is cycled, the SGI unit will power up into the state this configuration was saved. If the Output Condition was saved as **on** ( ), which means power enabled, a warning screen will be displayed at power up. The user will have 10 seconds to press (F1) and abort the operation. If the count times out, the supply output terminals will be live and programmed to the saved configuration values; see Section 3.2 for Output-Enabled Warning. All other saved configuration locations must be recalled to become active; see Section 3.8.3.

3.8.3 Recall

There are 10 memory locations (as above, PwrOn and 1-9) from which a programmed output configuration of Voltage, Current, OVP (Overvoltage Protection trip point) and Output Condition can be recalled.

From Home Menu Page 1 press (F2) to enter the Recall menu. Using the NavPad up/down arrows scroll through the list of saved configurations. Recall a saved configuration by pressing the function key (F2-F4) to the right of that configuration. If a configuration was saved with the Output Condition **on** ( ) and that configuration is recalled, a warning screen (See Menu Map, Section 3.7.9) will be displayed *****. The user is given the option to press Yes (F1) to enable or No (F4) to disable the output. All other settings

will be programmed according to the recalled configuration regardless of this choice.

**** Note:*** *The warning screen will not appear if the Output is already enabled.*

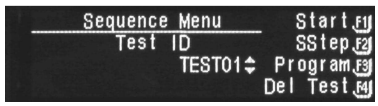
3.8.4 Sequencing

INTRODUCTION

The SGI sequencing function allows the user to set up the supply to automatically run a series of voltage, current and power mode operations. This is especially useful for setting up the supply to test to compliance standards, or unburdening the test computer in automated testing applications. Through RS-232, IEEE-488 or Ethernet, an external computer can trigger the sequences (see SG Series Programming Manual). Up to 50 sequences may be stored, with each sequence containing up to 20 individual steps. With the ability to string sequences together and an extensive list of step functions such as ramping, looping, goto and subroutine calls, the user can define a nearly infinite variety of test sequences.

The following sections will assist the user in programming, testing and running a sequence from the front panel.

BASIC SEQUENCE OPERATION



To access the main Sequencing menu press F3 from Home Menu Page 1. From here any one of 50 sequences may be selected. The default names for sequences are TESTxx where xx is a number from 01 to 50. Using SCPI commands via the RS-232, IEEE-488, or Ethernet interface, the user may rename these test sequences with meaningful names of up to 15 characters (see SG Series Programming Manual).

Note: *DO NOT use non-sequence-related SCPI commands while performing sequence operations.*

Note: *DO NOT use sequence SCPI commands as stand-alone commands outside a sequence.*

CAUTION!

RESTRICTIONS ON SEQUENCE PROGRAMMING
In order to allow maximum flexibility for generating small incremental changes during a test sequence, the SGI allows 1 ms time resolution on each step. With this capability, however, it is possible to create output changes with fast slew rates, that could generate potentially damaging large currents, in the output capacitors of the unit; refer to the guideline

note, below.

Note: *When creating test sequences, use the following guidelines to prevent damage to the unit:*

- *Estimate the AC frequency and peak-to-peak voltage, V(PK-PK) of the desired test sequence.*
- *Convert the estimated V(PK-PK) to a % of maximum output voltage (e.g., if V(PK-PK) is 10V and maximum voltage of the supply is 100V, then %V(PK-PK) = 10%)*
- *Verify that the frequency and %V(PK-PK) do not exceed the values below:*

Frequency	% V(PK-PK)
10Hz	25%
50Hz	5.0%
100Hz	2.5%
150Hz	1.67%
200Hz	1.25%

- *Another consideration is the actual rise and fall capabilities of the output of the supply. Although damage will not occur, the shape of the output waveform will be affected by the rise/fall times in relation to programmed sequence settings. These vary widely depending on the load conditions; contact the factory for further information.*

.

Note: *Contact the factory for detailed information if the desired waveform exceeds the recommended limits as discussed.*

To change the test sequence, use the NavPad up/down to scroll through the test list. From this menu the user may Start (F1), Single Step (F2), Program (F3) or Delete (F4) a sequence.

START: press F1 from the main Sequence Menu to start and run a test sequence. The display will show the test sequence name and step number (e.g., TEST01-12, Sequence TEST01, step 12). It will also indicate the current operation being executed (see Section 3.8.4.3, Operations) and will display voltage, current, OVP, power and time remaining for that step. The time format is hhhh:mm:ss:sss (last three digits are milliseconds).

User may pause or stop the test at any time by pressing either F3 to pause or F4 to stop the sequence. The output will pause or stop in the same state as the test step was when the key was pressed. Pressing F3 (Resume) restarts the sequence from the beginning of the same step. (***Note:*** *For steps with voltage or current ramps, the step will resume at the beginning of the ramp and not at the point at which the ramp was paused.*) Pressing F4 (Stop) to stop the sequence returns the display to the main Sequence Menu.

SINGLE STEP: press F2 from the main Sequence Menu to single step through a test sequence. The display will show the test sequence name and

step number. It will also indicate the current operation being executed and display voltage, current, OVP, power and time remaining for that step.

User may start the sequence after any step causing it to run in continuous mode, by pressing F1 (Start). The sequence will start from the beginning of the test sequence, not the beginning of the current step. To continue to single step through each sequence step, press F2 (NextStep). Pressing F2 NextStep before the timer ends, will replay the step. Pressing F4 (Stop) allows the user to stop the single step mode, and the display returns to the main Sequence Menu.

PROGRAM: press F3 from the main Sequence Menu to program a test sequence. The Test Sequence submenu shows the name of the current test sequence and step number. In addition it displays the primary operation of the test step (there are 13 different operations, see Section 3.8.4.3, Operations). From this submenu the user may copy (F1), paste (F2), insert (F3) or delete (F4) a test step.

CopyStep (F1): copies the current step characteristics into a buffer for later recall using the PasteStp (F2) function.

PasteStp (F2): pastes the current characteristics from the copy buffer into the existing test step.

Insert (F3): inserts a new step before the currently displayed test step. The default operation in the new step is set to NOP.

Delete (F4): deletes the current test step from the test sequence, and inserts NOP into step 20 of the sequence.

DEL TEST: press F4 from the main Sequence Menu to delete the entire currently selected test sequence. If Del Test is selected, a warning screen will appear prompting the user to either confirm (Yes – F1) or cancel (No – F4) the delete action. Deleting a test actually fills each test step in the sequence with a NOP (see Section 3.8.4.3)., and fills Step 21 with STOP operation.

STEP OPERATIONS

When programming a test sequence (see Section 3.8.4.2) each step operation can be any one of thirteen different functions. To access those functions, from Home Menu Page 1 press F3 (see Menu Map, Sections 3.7.2, 3.7.5, and 3.7.6), and use the NavPad to scroll through the various step operations (see Section 3.5, Navigation) while in the Sequence Step Programming submenu.

1. Once an operation has been selected for the present step, navigate to the editable items and input values for each setting as appropriate (see Section 3.6, Editing).

2. After programming a step, navigate to the step-number location on the screen and scroll to the next step number to be programmed.

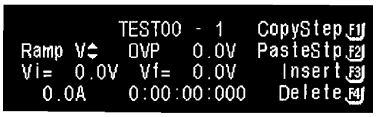
3. Once at the next step number to be programmed, start again by choosing an operation for that step and continue as described above.

4. At the end of the sequence or to abort the sequence, press either the Escape key or Menu to jump to the Save screen. F1 (Yes) saves the sequence (in non-volatile memory) and returns to main Sequence Menu. F4 (No) will *retain the current changes only until the power supply is turned off*. The next power on restores the sequence to its previous condition.

The following are descriptions for each sequence operation:

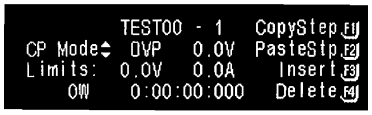
NOP, No Operation: Used as a placeholder in the test sequence, no values are changed during this step, and it does not add time to the sequence.

V/I Mode, Voltage/Current Mode: This operation sets the voltage, current and OVP to the programmed values for the set period of time during the sequence step. Navigate to each editable item to input values for Voltage, Current, Overvoltage Protection and duration.



Ramp V, Ramp Voltage: This operation allows the user to ramp the output voltage from an initial, or start, value (Vi) to a final, or stop, value (Vf) over the time period specified. Internally the unit uses Vi, Vf and the time to calculate an appropriate ramp function to drive the output during the test step. Use the NavPad to set the OVP, initial Voltage (Vi), final Voltage (Vf), Current limit, and duration.

Ramp I, Ramp Current: This operation allows the user to ramp the output current from an initial, or start, value (Ii) to a final, or stop, value (If) over the time period specified. Use the NavPad to set the OVP, initial Current (Ii), final Current (If), Voltage limit, and duration.



CP Mode, Constant-Power Mode: This operation is similar to the V/I Mode, except it sets the supply in a constant-power mode (See Section 3.8.5). Use the NavPad to input values for OVP, Voltage limit, Current limit, Constant Power setting and duration.

Repeat: This operation returns to the beginning of the test cycle (this could be a prior test sequence or the beginning of the current test sequence, depending on the number of branches and subcalls used in the affected sequences) and repeats all previously executed steps a single time. Once executed, the sequence continues to execute all remaining steps after the Repeat command. To repeat the preceding steps more than once, use the Loop operation.

Subcall: This operation calls another test that runs as a sub-sequence. If that sub-sequence includes a Return command, execution of the primary sequence resumes at the step following the Subcall step. Use the NavPad to scroll to the desired Test name and change as appropriate.

Return: This operation causes execution to resume at the step immediately following the most recent Subcall. When occurring in a primary sequence, without a prior Subcall, Return stops execution of the test sequence. Return is one of only three operations that may be used in step 21 of a test sequence.

Loop: This operation causes the unit to repeat all steps between the Loop operation and the Next operation for the specified number of counts (maximum of 65,535). Use the NavPad to set the Count for the total number of loops.

Use the Next operation after the last step to be repeated.

Once the Loop has completed the set number of counts, the unit will continue to execute the remainder of the sequence.

Next: Next is used at the end of a Loop to signify the end of the looped sequence.

If Next is not preceded by the Loop operation, *this is an INVALID condition*. If the program encounters the Next command under these conditions, the sequence will abort and the output power to the terminals will be disabled.

Stop: Stops the test sequence execution and retains the last programmed output value. The Stop operation may be used in step 21 of a sequence.

Goto: This operation allows the sequence to exit the existing test sequence and begin another test sequence. Goto is used to string together multiple sequences for a single test. The Goto operation may be used in step 21 of a sequence.

Pause: This operation suspends execution of the sequence and waits for operator input to press either the

Resume key to continue the sequence or the Stop key to end the sequence.

SEQUENCING EXAMPLE

The following provides an example of programming and running a test sequence.

A typical burn-in sequence requires the voltage to the device-under-test (DUT) to ramp up to a nominal voltage, allow the unit to soak at that voltage for a period of time, then 'bump' up that voltage to another level, soak, etc., then return the output back to zero. In some cases, an on/off power cycle sequence may also be required. Figure 3-11 provides a graphical representation of this example burn-in sequence.

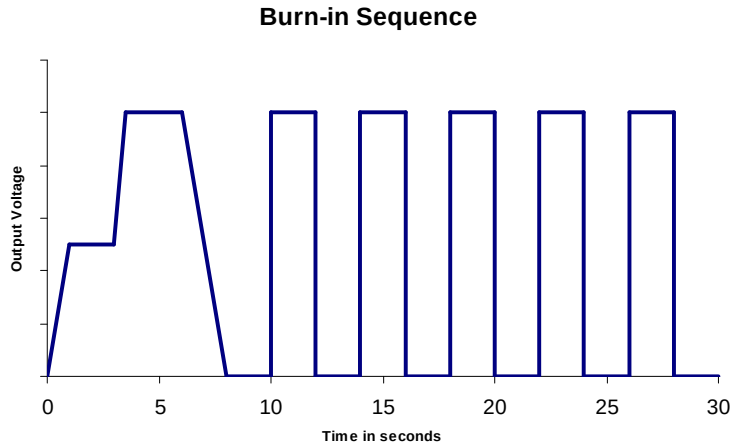


Figure 3-11. Burn-in Sequence Example

To begin programming a sequence it is important to know the exact settings for each step of the sequence. In this case, two sequences will be programmed: the first being the up/down ramp sequence, and the second the on/off sequence. The two will be strung together using a Goto command.

The example sequence will perform the following:

Sequence 1 – Up/Down Ramp

Step 1 – Ramp the output voltage from 0 V to 20 V over a 1 s period
Step 2 – Hold the voltage at 20 V for 2 s
Step 3 – Ramp the voltage from 20 V to 40 V over a 500 ms period
Step 4 – Hold the voltage at 40 V for 2.5 s
Step 5 – Ramp the voltage from 40 V to 0 V over a 2 s period
Step 6 – Hold the voltage at 0 V for 2 s
Step 7 – Go to sequence 2

Sequence 2 – On/Off Loop

Step 1 – Begin a loop and set the count to 5
Step 2 – Turn on the voltage to 40 V for 2 s
Step 3 – Turn off the voltage for 2 s
Step 4 – Execute the Next loop until all 5 are complete
Step 5 – Stop the sequence

Run the sequence.

To program these sequences, do the following:

Sequence 1 – Up/Down Ramp
From the Home Menu Page 1, select F3 to enter the main Sequence Menu. Use the NavPad up/down to select the sequence (Test ID) labeled TEST01. Press F4 (Del Test) to reset all steps in TEST01 to a NOP condition. This establishes a known state for this sequence. Press F3 to enter the Sequence Step menu.

Step 1 – Ramp the output voltage from 0 V to 20 V over a 1 s period
From the Sequence Step menu, use the NavPad to set the test step to the first step, TEST01-1. Use the NavPad to set the operation to Ramp V mode. Set OVP to an appropriately high level (60 V for this example), Vi to 0 V, Vf to 20 V and current to a nominal 10 A (for this example we assume there is no load – or a very light load – connected to the output). Set the time duration to 1 s or (0:00:01:000). Once these values are set, press the F1 key to copy this setup into the copy buffer for later use.

Step 2 – Hold the voltage at 20 V for 2 s
Use the NavPad to change to the next step (TEST01-2). Select the V/I Mode operation and set the OVP to 60 V, voltage to 20 V, current to 10 A and time duration to 2 s.

Step 3 – Ramp the voltage from 20 V to 40 V over a 500 ms period
Use the NavPad to change to the next step (TEST01-3). Use the F2 key to paste in a copy of the previously saved Ramp V step. Make changes to this step by changing Vi to 20 V, Vf to 40 V and the time duration to 500 ms (0:00:00:500)

Step 4 – Hold the voltage at 40 V for 2.5 s
Use the NavPad to change to the next step (TEST01-4). Select the V/I Mode operation and set the OVP to 60 V, voltage to 40 V, current to 10 A and time duration to 2.5 s.

Step 5 – Ramp the voltage from 40 V to 0 V over a 2 s period
Use the NavPad to change to the next step (TEST01-5). Use the F2 key to paste in a copy of the previously saved Ramp V step. Make changes to this step by changing Vi to 40 V, Vf to 0 V and the time duration to 2 s.

Step 6 – Hold the voltage at 0 V for 2 s

Use the NavPad to change to the next step (TEST01-6). Select the V/I Mode operation and set the OVP to 60 V, voltage to 0 V, current to 10 A and time duration to 2 s.

Step 7 – Go to sequence 2
Use the NavPad to change to the next step (TEST01-7). Select the Goto operation and set the next step to TEST02. Press the ESC or Menu key to move to the Save Sequence screen and press F1 for Yes.

Sequence 2 – On/Off Loop
From the Home Menu Page 1, select F3 to enter the main Sequence Menu. Use the Navigation arrows to select the sequence labeled TEST02. Press F4 (Del Test) to reset all steps in TEST02 to a NOP condition. Press F3 to enter the Sequence Step menu.

Step 1 – Begin a loop and set the count to 5
Use the NavPad to change to the first step (TEST02-1). Select the Loop operation and set the count to 5.

Step 2 – Turn on the voltage to 40 V for 2 s
Use the NavPad to change to the next step (TEST02-2). Select the V/I Mode operation and set the OVP to 60 V, voltage to 40 V, current to 10A and time duration to 2 s. Press F1 to copy this step to the copy buffer.

Step 3 – Turn off the voltage for 2 seconds
Use the NavPad to change to the next step (TEST02-3). Press the F2 key to paste the previously saved step into this step. Set the voltage to 0 V, all other settings remain the same.

Step 4 – Execute the Next loop until all 5 are complete
Use the NavPad to change to the next step (TEST02-4). Select the Next operation.

Step 5 – Stop the sequence
Use the NavPad to change to the next step (TEST02-5). Select the Stop operation. Press the ESC or Menu key to move to the Save Sequence screen and press F1 for Yes.

This completes programming of the sequences.

To run this sequence, from Home Menu Page 1, press F3 to enter the main Sequence menu. Select TEST01 test sequence and press F1 to start the sequence. The display will show progress of the sequence and should complete in approximately 30 s.

3.8.5 Constant-Power Mode

The Constant-Power Mode allows the supply to regulate the output to a constant power setting as opposed to the more common constant voltage or constant current modes of operation (see Section 3.2). (***Note:*** *This mode is intended primarily for loads with response times greater than approximately 10 ms*). While in this mode, the supply will continually adjust the voltage and current levels to attempt to maintain a constant power to the load. In order to provide additional protection for the load, voltage, and current limits may be set while in the Constant-Power mode. If the unit cannot regulate to the Constant Power setting due to load conditions, it will regulate either at the voltage or current limit depending on the load demand. See Figure 3-12.

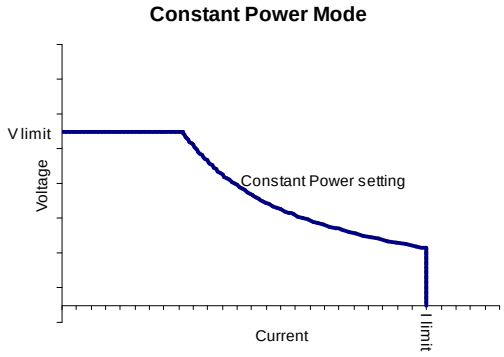
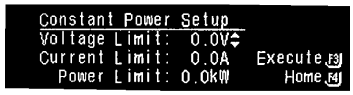
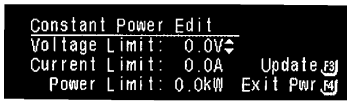


Figure 3-12. Constant-Power Example

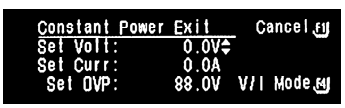


To access the Constant Power Setup menu, press the F4 key from Home Menu Page 1. Navigate to each editable item and enter the appropriate values. Press F3 to execute (the display jumps to Constant Power screen) or F4 to abort (the display returns to Home Menu Page 1).

From Constant Power screen, the user may either edit the limits again or exit Power mode. F3 jumps to Constant Power Edit screen, and after inputting new values, press F3 to make those changes effective and jump back to Constant Power Screen, or press F4 to ignore the changes and jump to Constant Power Exit.



From Constant Power Exit, F1 cancels the command to exit and jumps back to Constant Power screen, or F4 exits Constant Power and jumps to Home Menu Page 1 with the Voltage, Current, and OVP values as set. (See Menu Map, Section 3.7.8).



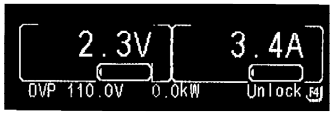
3.8.6 Home Timeout

The display jumps to this screen when the system has been idle for 30 seconds. Press Escape or F4 to return to Home Menu Page 1.

3.8.7 Display Brightness

Navigate from Home Menu Page 2, F1; use NavPad to dim or increase the brightness. F1 saves the adjusted setting for the remainder of the session and for future power-ups. F4 maintains the setting for the remainder of the session and returns the brightness to its previously saved level at next power-up.

3.8.8 Lock Key



To prevent changes due to accidental pressing of the keys, Lock the keys from Home Menu Page 2, F2. This screen appears until F4 is pressed; a confirmation screen will appear with instructions to press Enter to unlock keys (see Section 3.7.12, Other Screens) before returning to Home Menu.

NOTE: *Lock Key only works while in the Constant-Voltage or Constant-Current modes.*

3.8.9 Language

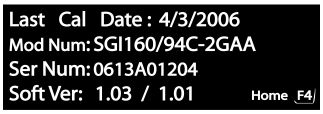
The Language submenu allows the user to change the default language for the menu selections. To select this menu, from Home Menu Page 2 press F3 to go to the Language Menu and select a language to work in. Pressing F1 will save the selection and exit the Language Menu. The next time the unit is powered up it will be in the last saved language. Pressing F4 will keep the selected language only for the remainder of the session and will revert to the previously saved language at next power-up.

FOREIGN LANGUAGE

If the unit is set to a language foreign to the user, press the escape key until Home Menu Page 1 appears. (Even in a foreign language, the Voltage and Current values will still display: value with the letter V and value with the letter A, respectively. Also, there will be only one inter-screen navigation arrow, which is located at the bottom of the

screen). Use the NavPad to scroll down to Home Menu Page 2 (there will be two inter-screen navigation arrows, one at the top and one at the bottom of the screen). Press F3, which jumps to the Language Menu, and then use the NavPad to scroll to the user's native language.

3.8.10 Info



The Supply Information screen shows the date that the unit was last calibrated, Model Number and Serial Number of the unit, and version of the software. To access this screen, from Home Menu Page 2 press F4.

3.8.11 Remote

Remote, F1, provides screens for either the Ethernet option or the GPIB option, described in the following subsections.

ETHERNET

The Ethernet Remote Menu displays the Ethernet MAC address of the power supply, which cannot be edited. Access the menu from Home Menu Page 3, F1 key. This menu also displays in the IP IN USE: line, the IP address presently in use from either a static IP setting or from the DHCP server, depending on how assigned. The Baud Rate is editable via the NavPad; changing it here changes the rear panel RS-232 SCPI baud rate. The initial factory setting is 19200.

LXI

The LXI submenu (F3 from the Remote Menu) displays two settings required by the LXI requirements.

PING Response: enables or disables the power supply's response to a ping packet sent from a remote Ethernet host. To change the setting to either ENABLED or DISABLED, move the editing arrows to the PING Response: line by pressing NavPad left/right, and then change the setting by pressing NavPad up/down. Press F1 to Cancel the change and return to the Remote Menu screen, or press F4 to Save the changed setting.

Identification: controls the LAN LED on the power supply's rear panel. ENABLED causes the LAN LED to flash for visual identification. DISABLED causes the LAN LED to be steady-lit to indicated the power supply's connected status. To change the setting, move the editing arrows to the Identification field by pressing NavPad left/right, and then change the setting by pressing NavPad up/down. Press F1 to Cancel the change and

return to the Remote Menu screen, or press F4 to Save the changed setting.

ETHERNET

The Ethernet submenu (F4 from the Remote Menu) displays the Primary (Pri Config) and Secondary (Sec Config) Ethernet configurations, both of which are editable. It also provides further submenus to change the Server Listener Port (F3) and the Static IP address (F4).

The Primary configuration is attempted at power-up, and if it fails, the system defaults to the Secondary configuration. However, both setting "DHCP-acquired" *and* selecting "Auto IP Enabled" together in the Primary configuration, prevents the power supply from trying the Secondary configuration.

Useful configurations are described as follows:

Pri Config: STATIC IP
Sec Config: DHCP
At power-up the power supply will assign itself the configured static IP address. If no other device is using the IP address, the power supply continues with that static IP address. If some other device is using that address, the power supply will move to Secondary and attempt to acquire an IP address from a DHCP server repeatedly until it gets an address.

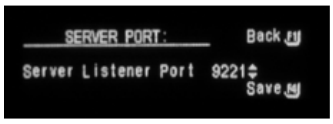
Pri Config: STATIC
Sec Config: DHCP+AUTOIP
At power-up the power supply will assign itself the static IP address. If no other device is using the IP address, the power supply continues with that static IP address. If some other device is using that address, the power supply will move to secondary and attempt to acquire an IP address from a DHCP server. If it cannot find a DHCP server to assign an address, it will assign itself a link-local address. If no other device is using that link-local address it will use it for 5 minutes minimum. At that time, if it is already in communication with some other device, it will hold onto that link-local address until the communication is finished and then retry DHCP. Then, if DHCP is not available, the power supply will revert to the last successful link-local address for another 5 minutes minimum.

Pri Config: DHCP
Sec Config: STATIC
At power-up the power supply will attempt to acquire an IP address from a DHCP server. If it cannot find a DHCP server to assign an address, the power supply will move to Secondary and assign itself the static IP address. If no other device is using the IP address, the power supply continues with that static IP address. If some other device is using the static IP address, the power supply will move back to Primary and start the entire operation again.

Pri Config: DHCP+AUTOIP
Sec Config: will not be used with the Pri Config, above
At power-up the power supply will attempt to acquire an IP address from a DHCP server. If it cannot find a DHCP server to assign an address, it will

assign itself a link-local address. If no other device is using that link-local address, it will use it for 5 minutes minimum. At that time, if it is already in communication with some other device, it will hold onto the link-local address until the communication is finished and then retry DHCP. If DHCP is not available, the power supply will revert to the last successful link-local address for another 5 minutes minimum.

PORT



The Server Port Menu is used to set the network TCP/IP socket listening port. Valid values are 1025 to 65535. The factory default setting is 9221. To change, press NavPad up/down or use the numeric keys to enter specific values. Press F4 to save the change or press F1 to return to the Ethernet menu without changing anything.

STATIC IP CONFIGURATION

The Static IP menu allows manual setting not only of the IP address, but also subnet mask, gateway and Domain Name Server (DNS) server. The four IP octets in each field are edited one at a time. Navigate to each octet by pressing NavPad left/right, then change the value by either pressing NavPad up/down or by entering a specific value with the numeric keys.

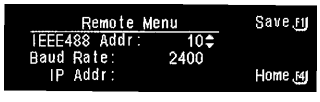
IP: input any standard IP address. (Factory setting is 192.168.0.200). Press F4 to save the changes or press F1 to return to the Ethernet menu without changing anything.

MASK: input a value that identifies which network segment your power supply is on, consisting of 4 whole numbers, each ranging from 0 through 255, separated by periods. (Factory setting is 255.255.255.0, a class-C network subnet mask). Press F4 to save the change or press F1 to return to the Ethernet menu without changing anything.

GATE: input the IP Address of any gateway that stands between the instrument and any other network entities that communicate with the power supply. (No factory setting). Press F4 to save the change or press F1 to return to the Ethernet menu without changing anything.

DNS: input an IP address for the Domain Name System (DNS) server. Press F4 to save the change or press F1 to return to the Ethernet menu without changing anything.

GPIB

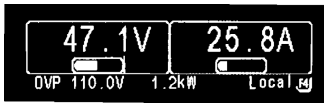


The Remote Menu for GPIB option (Home Page 3, F1) allows setting of the GPIB address and the baud rate for the RS232C interface. Use the NavPad to set the GPIB address from 1 to 30, and the RS-232 baud rate from

2400 to 19200. Pressing F1 saves the new values in non-volatile memory so that they will be remembered after power down. Pressing F4 keeps the selected values only until the unit is power down; then, at next power up, the previously saved settings will be restored.

REMOTE OPERATION SCREENS

If the unit is being controlled remotely via Ethernet, GPIB or RS-232 interface, special screens may appear during operation. The following describes those displays:



- Remote Mode Primary display shows the actual values for Volts and Watts. F4 jumps to Home Timeout screen.

- Remote Mode Power display shows the set points on the first line, actual values for Voltage and Current on the second line, and at the bottom, the actual value for Watts with a bar graph of its percent of full-scale power. F4 jumps to the Constant Power screen.

- Remote Mode Sequence display shows what sequence is running. F4 jumps to the local Sequence Run screen.

3.8.12 System

The System submenu allows the user to display the total system current when the unit is being paralleled with other SG series supplies.

From Home Menu Page 3, press F2 to enter the System Menu. Determine the Total System Current by adding the maximum current rating of all supplies in parallel. Use NavPad or the KeyPad "0-9" to enter the appropriate value. F3 resets Total System Current to the supply default value; F4 keeps the displayed value and jumps to Home Menu Page 1.

3.8.13 Warning Screens

There are two warning screens that may appear during the course of operation:

HARD FAULT

Hard Fault warns that a hardware fault has occurred in a power module, such as an overtemperature, undervoltage of AC input, or converter failure. These conditions might clear themselves, however, if they continue to occur after pressing the F4 (ClrFault) key, contact the factory for service assistance.

OVP FAULT

OVP Fault occurs when the output voltage of the supply exceeds the OVP setting. When this occurs the output is disabled, and voltage and current output go to 0. To clear the display, press F1 (Clr OVP). The display will return to Home Menu Page 1, and the output will remain disabled.

Note: *It is important to correct the condition that caused the OVP, prior to re-enabling the output.*

3.9 Remote Analog Control Connector (J1)

The Analog Control connector of the Remote Analog Interface on the rear panel allows the unit to be configured for different operating configurations: front panel (local) and remote programming of voltage, current, and OVP, voltage and current monitoring, output enable/disable, etc. Refer to Figure 3-13 for the connector pin-out diagram. The setup and operating requirements of each configuration are provided in Sections 3.10 through 3.13.3.

The SGI also has the capability of providing summing of remote analog input with the set values on the front panel (or programmed values via the digital interface) for voltage, current and OVP. This capability provides a means to modulate a set value with the signal on the voltage, current and OVP analog input. If the user only desires to control the unit with the analog input, all the front panel values (V/I/OVP) or digital settings should be set to zero.

CAUTION!

If standard, Remote Non-Isolated Analog Interface programming is used, the programming return (J1-6 and J1-24) is at the same potential as the negative output terminal of the power supply (not isolated). Proper connection should be made to signal returns with respect to input programming equipment. Improper connection might result in ground/return loops and, as a result, internal power supply damage might occur; output current could then flow by way of the external connection to the J1 common (J1-6 and J1-24). Refer to Table 3–5.

REMOTE ANALOG ISOLATED INTERFACE CONTROL (OPTION)

The Remote Isolated Analog Interface control uses the same Analog Control connector (J1) as the standard interface. This option fully isolates remote control signals and allows control of units not connected to a common ground. Control ground is isolated from output power (output negative terminal), which protects against potential damage from systems with high electrical noise or large ground loop currents.

Note: *Some standard, Non-Isolated Analog Interface programming signals are not available with this option; see Table 3–5 for details.*

CAUTION!

The Remote Isolated Analog Interface option is not intended to allow operation of the power supply at excessive voltages. Operation of Isolated Analog Interface signals should be at SELV safety voltage conditions to chassis ground. Refer to Section 1.2.2 for maximum terminal voltages.

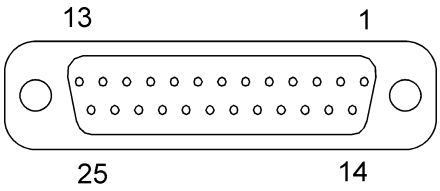


Figure 3-13. Analog Control Connector (J1) Pin-Out

Pin	Reference	Electrical Parameters	Functional Description
1	ISO ON/OFF	Zin ~ 6 kΩ in series with anode of opto-isolator LED	Isolated remote control input for output on/off with an applied AC/DC voltage source. A positive (+) 6-120 VDC or an AC input of 12- 240 VAC will enable (turn-on) the output of the supply. This control input is optically isolated from the output power negative terminal of the power supply (up to 500 VDC). Signal return is Pin J1-2 (ISO RTN). See Section 3.13.
2	ISO RTN	—	Isolated signal return for on/off control using Pins J1-1 and J1-14. Optically isolated from the output power negative terminal of the power supply (up to 500 VDC).
3	REM OV SET	Zin ~ 20 kΩ	Control input for remote programming of the overvoltage protection: 0.25-5.5 VDC = 5-110% of full-scale output voltage. Reset of an OVP condition is possible by applying an 10.5-13.3 VDC signal for 7 seconds. Signal return is Pin J1-6 (COM). Circuit is electrically connected to the output power negative terminal. See Section 3.12.
4	VP RTN	Zin ~ 10 kΩ	Voltage programming signal return to be used with Pins J1-9, J1-15 or J1-21; also must be externally connected to Pin J1-6 (COM) signal return when voltage programming is utilized. Circuit is electrically connected to the output power negative terminal.
5	ON/OFF	Zin ~ 10 kΩ pull-up to 15 VDC	Remote control input for output on/off: switch/relay contact closure or direct short-circuit from this terminal to Pin J1-6 (COM) signal return will enable (turn-on) the output of the supply; remote circuit must sink up to 1.5 mA from 15 VDC to enable. Circuit is electrically connected to the output power negative terminal. See Section 3.13.
6	COM †	—	Signal return. Internally connected to Pin J1-24. Circuit is electrically connected to the output power negative terminal.
7	I MON	Zout ~ 100 Ω	Monitor signal for output current: 0-10 VDC = 0-100% of full-scale output current. Minimum recommended load resistance is 100 kΩ. Circuit return is Pin J1-6 (COM). Circuit is electrically connected to the output power negative terminal.
8	V SET *	Zout ~ 100 Ω	Monitor signal for front panel voltage potentiometer setpoint: 0-5 VDC = 0-100% of full-scale setpoint. Minimum recommended load resistance is 100 kΩ. Signal return is Pin J1-6 (COM). Circuit is electrically connected to the output power negative terminal.
9	VP 5V	Zin ~ 10 kΩ	Control input for remote voltage programming using a voltage source: 0-5 VDC = 0-100% of full-scale output voltage. Do not exceed an input of 13.3 VDC. Signal return is Pin J1-4 or Pin J1-20 (VP RTN). Circuit is electrically connected to the output power negative terminal. See Section 3.11.
10	IP 5V	Zin ~ 10 kΩ	Remote control input for current programming using a voltage source: 0-5 VDC = 0-100% of full-scale output current. Do not exceed an input of 13.3 VDC. Signal return is Pin J1-23 or Pin J1-25 (IP RTN). Circuit is electrically connected to the output power negative terminal. See Section 3.10.

Pin	Reference	Electrical Parameters	Functional Description
11	ISET *	Zout ~ 100 Ω	Monitor signal for front panel current potentiometer setpoint: 0-5 VDC = 0-100% of full-scale setpoint. Minimum recommended load resistance is 100 kΩ. Signal return is Pin J1-6 (COM). Circuit is electrically connected to the output power negative terminal.
12	Not Used		
13			
14	ISO TTL/CMOS	Zin ~ 900Ω in series with anode of opto-isolator LED	Isolated remote control input for output on/off with a logic signal: a logic-high, 5 VDC TTL/CMOS signal will enable (turn-on) the output of the supply, and a logic-low signal disables (turns off) the output. This control input is optically isolated from the output power negative terminal of the power supply (up to 500 VDC). Signal return is Pin J1-2 (ISO RTN). See Section 3.13.
15	VP 10V	Zin ~ 20 kΩ	Remote control input for voltage programming using a voltage source: 0-10 VDC = 0-100% of full-scale output voltage. Do not exceed an input of 25 VDC. Signal return is Pin J1-4 or Pin J1-20 (VP RTN). Circuit is electrically connected to the output power negative terminal. See Section 3.11.
16	IP 10V	Zin ~ 20 kΩ	Remote control input for current programming using a voltage source: 0-10 VDC = 0-100% of full-scale output current. Do not exceed an input of 25 VDC. Signal return is Pin J1-4 or Pin J1-20 (VP RTN). Circuit is electrically connected to the output power negative terminal. See Section 3.10.
17	FAULT	Zout ~ 1 kΩ	Output signal for indicating a fault state: a logic-high state (approximately +10 VDC) indicates a fault has occurred in a power module, such as overtemperature, undervoltage of AC input, or converter failure; front panel Fault LED will also be lit. Signal return is Pin J1-6 (COM). Circuit is electrically connected to the output power negative terminal.
18	S/D FAULT	Zout ~ 100 Ω	Output signal for shutdown/fault state: a logic-high state indicates shutdown produced by an OVP condition, Power-On-Reset (POR), remote disable, or housekeeping supply fault. An 8 VDC minimum output signal is provided into a load of 10 kΩ load. Signal return is Pin J1-6 (COM). Circuit is electrically connected to the output power negative terminal. See Section 3.13.3.
19	V MON	Zout ~ 100 Ω	Monitor signal for output voltage: 0-10 VDC = 0-100% of full-scale output voltage. Minimum recommended load resistance is 100 kΩ. Circuit return Pin J1-6 (COM). Circuit is electrically connected to the output power negative terminal.
20	VP RTN	Zin ~ 10 kΩ	Voltage programming signal return to be used with Pins J1-9, J1-15 or J1-21; also must be externally connected to Pin J1-6 (COM) signal return when voltage programming is utilized. Circuit is electrically connected to the output power negative terminal.
21	VP RES *	1mA current source with compliance	Current source of 1 mA for remote voltage programming using a resistance connected to signal return Pin J1-4 or Pin J1-20 (VP RTN): 0-5 kΩ = 0-100% of full-scale output

Pin	Reference	Electrical Parameters	Functional Description
		voltage of ~ 10.8 V	voltage. Circuit is electrically connected to the output power negative terminal. See Section 3.11.
22	IP RES *	1mA current source with compliance voltage of ~ 10.8 V	Current source of 1 mA for remote current programming using a resistance connected to signal return Pin J1-23 or Pin J1-25 (IP RTN): 0- 5 kΩ = 0-100% of full-scale output current. Circuit is electrically connected to the output power negative terminal. See Section 3.10.
23	IP RTN	Zin ~ 10 kΩ	Current programming signal return which is to be used with Pins J1-10, J1-16 or J1-22; also must be externally connected to Pin J1-6 (COM) signal return when current programming is utilized. Circuit is electrically connected to the output power negative terminal.
24	COM †	—	Signal return. Internally connected to Pin J1-6. Circuit is electrically connected to the output power negative terminal.
25	IP RTN	Zin ~ 10 kΩ	Current programming signal return which is to be used with Pins J1-10, J1-16 or J1-22; also must be externally connected to Pin J1-6 (COM) signal return when current programming is utilized. Circuit is electrically connected to the output power negative terminal.

† With the option, Remote Isolated Analog Interface control, the control signal return is isolated from the output power negative terminal. See Section **Error! Reference source not found.** and Section 3.15.

* Signals not available with the option, Remote Isolated Analog Interface control.

Table 3–5. Analog Control Connector (J1), Designations and Functions

3.10 Remote Current Programming

Remote current programming is summed with the front panel or digital setting; see Section 3.9. Remote current programming is used for applications that require the output current be programmed (controlled) from a remote instrument. An external resistance or external voltage source may be used as a programming device. When using remote current programming, a shielded, twisted-pair cable is recommended to prevent noise interference to programming signals.

3.10.1 Remote Current Programming by Resistance

The resistance-programming coefficient for output current is (100% rated output current) / 5 kΩ, with input at Pin J1-22 (IP RES) and return to Pin J1-23 (IP RTN). An internal current source, factory-set at 1 mA, from Pin J1-22 (IP RES) is utilized to drive the resistance. This produces a transfer function for output current, as follows:

Iout = R * (100% rated output current) / 5 kΩ), with R in ohms.

If multiple switches or relays are used to select resistors to program different current levels, make-before-break contacts are recommended.

Note: *If an external resistance is used for remote programming, the current programming return Pin J1-23 (IP RTN), must be connected directly to, or within ±3 V, of the circuit common, Pins J1-6 and J1-24. See Figure 3-14 for connection requirements.*

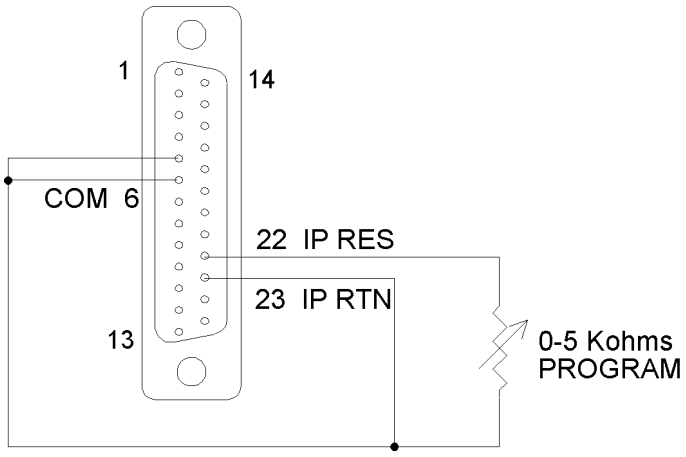


Figure 3-14. Remote Current Programming Using Resistance

3.10.2 Remote Current Programming by Voltage Source

Two inputs are provided for remote voltage-programming of the output current: 5 VDC full-scale and 10 VDC full-scale. The DC voltage source is connected between Pin J1-10 (IP 5 V) for 5 VDC source, or Pin J1-16 (IP 10 V) for 10 VDC source, and the return Pin J1-23 (IP RTN).

The corresponding voltage-programming coefficients for output current are (100% rated output current) / 5 VDC, or (100% rated output current) /10 VDC, from the respective inputs with return to Pin J1-23 (IP RTN). This produces transfer functions for output current, as follows:

Iout = Vdc * (100% rated output current) / 5 VDC), with Vdc in volts, or

Iout = Vdc * (100% rated output current) / 10 VDC), with Vdc in volts.

Note: *The return Pin J1-23 (IP RTN) must be referenced directly to, or within ±3 V, of the circuit common, Pins J1-6 and J1-24. See Figure 3-15 for connection requirements.*

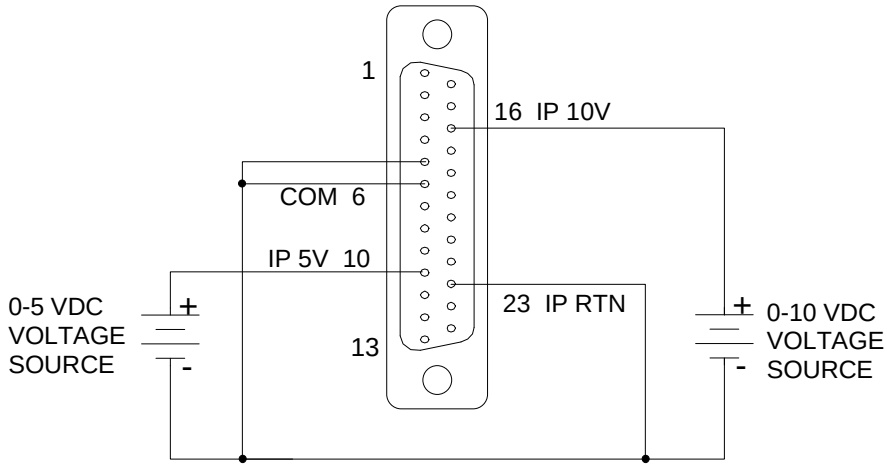


Figure 3-15. Remote Current Programming Using 0-5 VDC or 0-10 VDC Source

3.11 Remote Voltage Programming

Remote voltage programming is summed with the front panel or digital setting; see Section 3.9. Remote voltage programming configuration is used for applications that require the output voltage be programmed (controlled) from a remote instrument. An external resistance or external voltage source may be used as a programming device. When using remote voltage programming, a shielded, twisted-pair cable is recommended to prevent noise interference to programming signals.

3.11.1 Remote Voltage Programming by Resistance

The resistance-programming coefficient for output voltage is (100% rated output voltage) / 5 kΩ, with input at Pin J1-21 (VP RES) and return to Pin J1-20 (VP RTN). An internal current source, factory-set at 1 mA, from Pin J1-21 (VP RES) is utilized to drive the resistance. This produces a transfer function for output voltage, as follows:

Vout = R * (100% rated output voltage) / 5 kΩ), with R in ohms.

Note: *If an external resistance is used for remote programming, the voltage programming return Pin J1-20 (VP RTN) must be connected directly to, or within ±3 V, of the circuit common, Pins J1-6 and J1-24. See Figure 3-16 for connection requirements.*

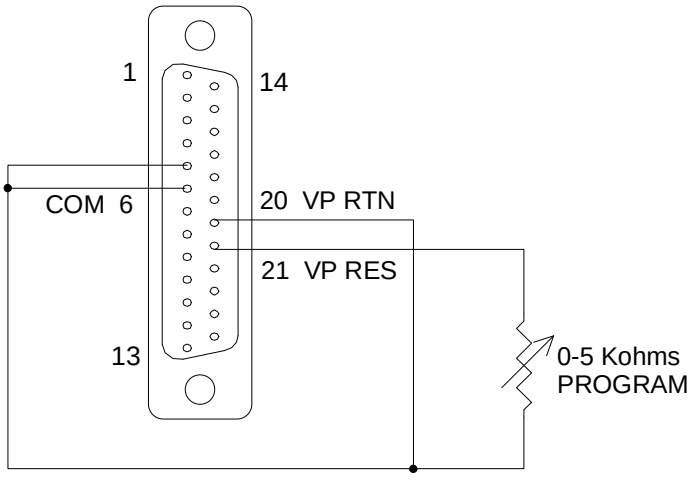


Figure 3-16. Remote Voltage Programming Using Resistance

3.11.2 Remote Voltage Programming by Voltage Source

Two inputs are provided for remote voltage-programming of the output voltage: 5 VDC full-scale and 10 VDC full-scale. The DC voltage source is connected between Pin J1-9 (VP 5 V) for 5 VDC source, or Pin J1-15 (VP 10 V) for 10 VDC source, and the return terminal J1-20 (VP RTN).

The corresponding voltage-programming coefficients for output voltage are (100% rated output voltage) / 5 VDC, or (100% rated output voltage) /10 VDC, from the respective inputs with return to Pin J1-20 (VP RTN). This produces transfer functions for output voltage, as follows:

Vout = Vdc * (100% rated output voltage) / 5 VDC), with Vdc in volts, or

Vout = Vdc * (100% rated output voltage) / 10 VDC), with Vdc in volts.

Note: *The return terminal (VP RTN) must be referenced directly to, or within ±3 V, of the circuit common, Pins J1-6 and J1-24. See Figure 3-17 for connection requirements.*

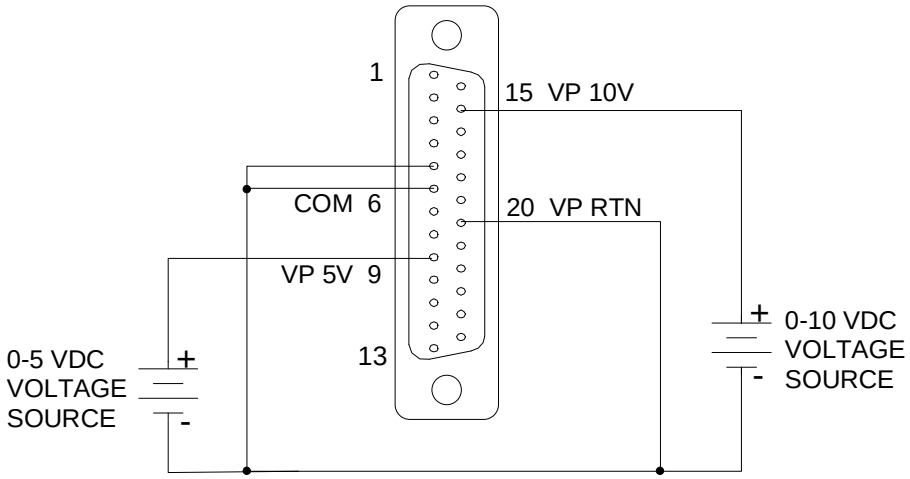


Figure 3-17. Remote Voltage Programming Using 0-5 VDC or 0-10 VDC Source

3.12 Remote Overvoltage Programming

CAUTION!
Do not program the remote overvoltage setpoint greater than 10% above the power supply rated voltage (5.5 VDC programming voltage source), as internal power supply damage might occur (except reset, see note below).

Remote Overvoltage Protection (OVP) programming is summed with the front panel or remote digital setting; see Section 3.9. A remote DC voltage source can be connected externally between Pins J1-3 (REM OV SET) and J1-6 (COM) to set the output overvoltage trip level. A 0.25-5.5 VDC signal equals 5-110% of rated output voltage. See Figure 3-18 for connection requirements.

Note: *To reset an OVP, apply a 10.5–13.3 VDC signal to Pin J1-3 for a minimum of 7 s.*

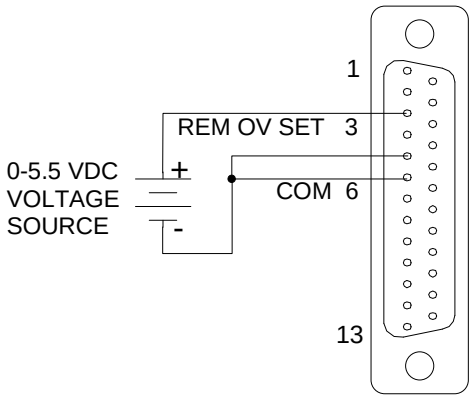


Figure 3-18. Remote Overvoltage Programming Using DC Voltage Source

3.13 Remote Output On/Off Control

Remote output on/off control may be accomplished by contact closure, or through an opto-isolated interface with external voltage sources, AC/DC or TTL/CMOS.

3.13.1 Remote Output ON/OFF by Contact Closure

Application of a contact closure between Pins J1-5 and J1-6 will enable the output. See Figure 3-19 for connection requirements.

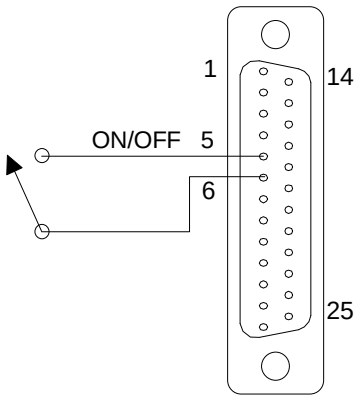


Figure 3-19. Remote Output On/Off Control by Contact Closure

3.13.2 Remote Output ON/OFF Control by External Source

Application of AC/DC voltage between Pins J1-1 and J1-2, or TTL/CMOS voltage between Pins J1-14 and J1-2, will turn on the power supply; this interface is opto-isolated from circuit common, Pins J1-6 and J1-24. See Figure 3-20 and Figure 3-21 for connection requirements.

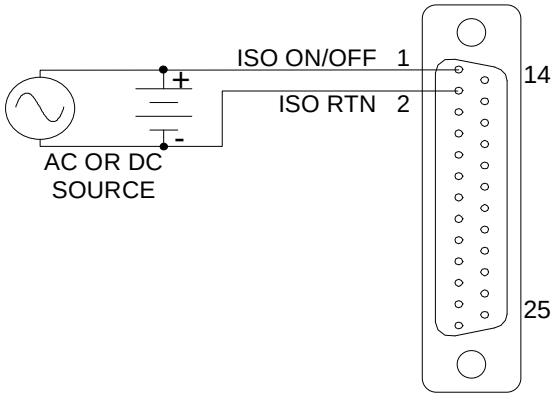


Figure 3-20. Remote Output On/Off Using Isolated AC or DC Source

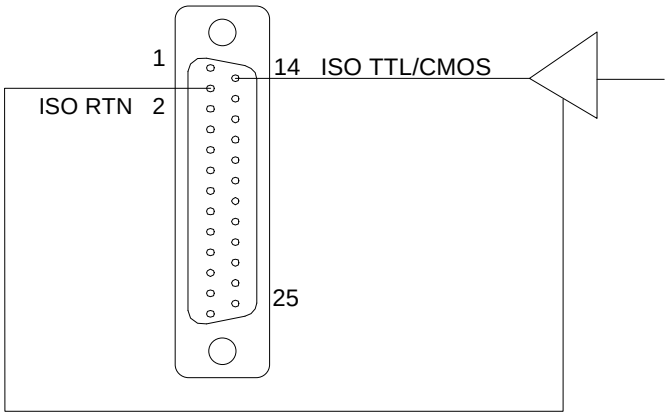


Figure 3-21. Remote Output On/Off Using Isolated TTL/CMOS Source

3.13.3 Remote Shutdown(S/D)

A remote +12 VDC voltage can be connected externally between Pin J1-18 (S/D Fault) and Pin J1-24 (COM) to disable, i.e., shut down the output of the power supply; see Figure 3-22. A low-level, or opening the +12 VDC signal, will allow the unit to revert to normal operation.

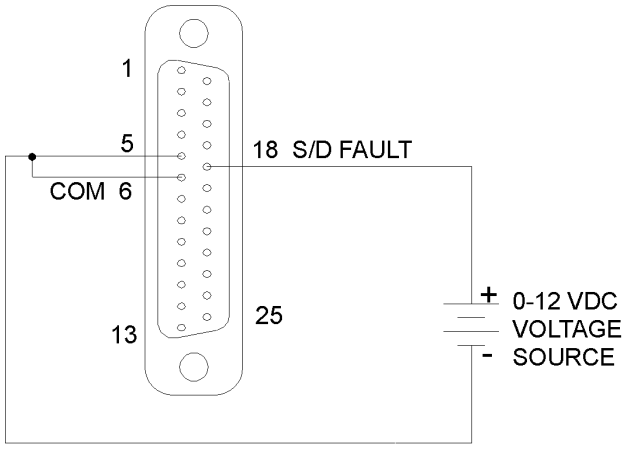


Figure 3-22. Remote Shutdown Using DC Voltage Source

3.14 Remote Sensing

Remote voltage sensing is recommended at all times, whether the sense leads are connected to the load or to the output terminals. Remote sensing is required to meet the performance specifications of the power supply. It is essential in applications where the load is located some distance from the power supply, or the voltage drop of the power output leads significantly interferes with load regulation.

The voltage accuracy specifications are valid only with remote sense connected. Disconnecting the remote sense leads will introduce an error, with the output voltage increasing. The error occurs because an additional resistance (PTC local resistor network in Figure 3-23) is present in the circuit of the resistor divider for voltage sensing, to provide the default local sensing of the output voltage at the output terminals. When remote sense is connected the PTC local resistor network is short-circuited, effectively removing it from the circuit.

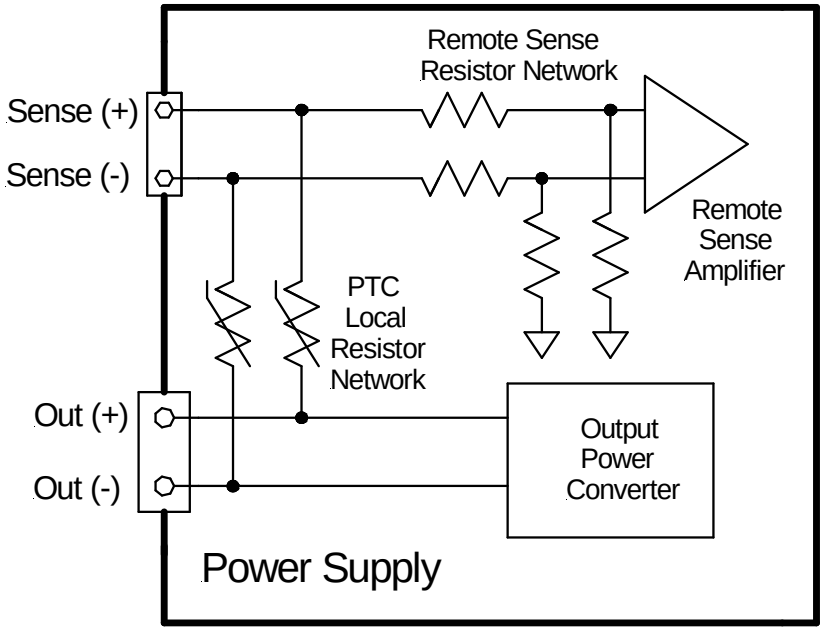


Figure 3-23. Remote Voltage Sensing Network

CAUTION!
If the power supply is operated with load power lines disconnected and remote sense lines connected, internal power supply damage might occur, since output load current could flow through the remote sense terminals.

To use remote voltage sensing, connect the power supply as described below in Figure 3-24 for 10V-800V models, and Figure 3-25 for the 1000V model. A shielded, twisted-pair cable is recommended to avoid potential noise interference.

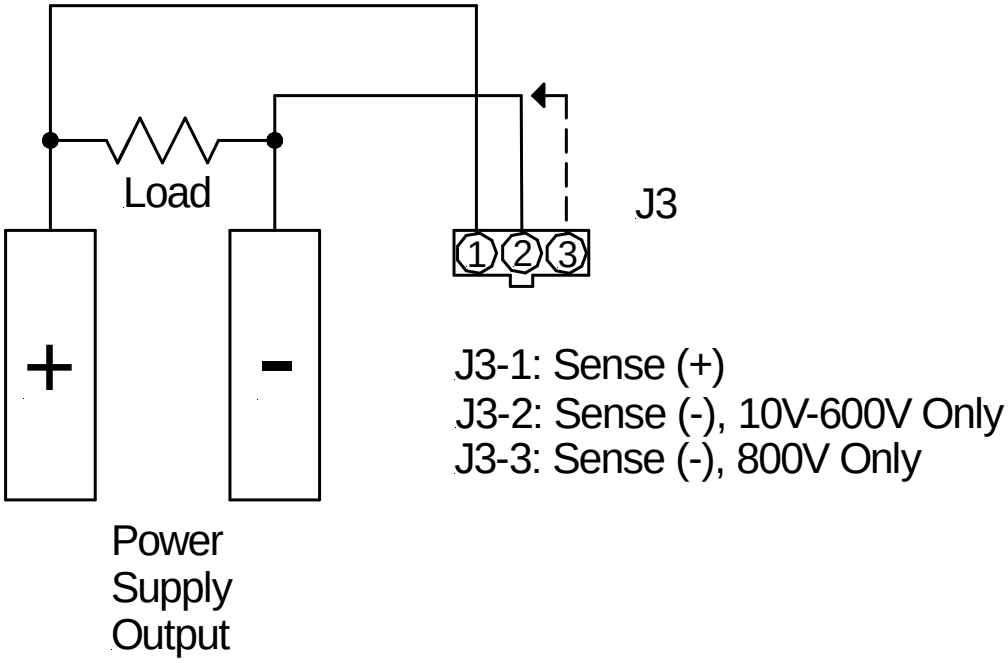


Figure 3-24. Remote Sense Connection at the Load, 10V-800V Models

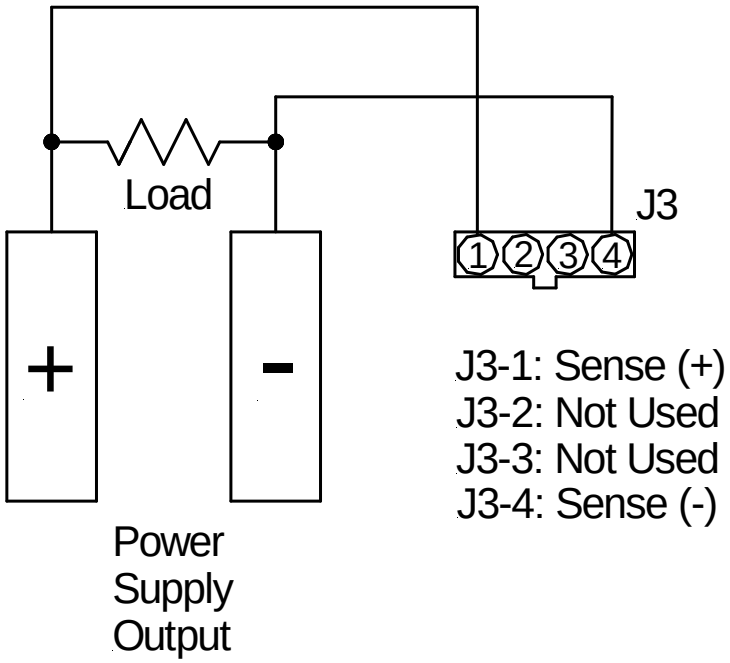


Figure 3-25. Remote Sense Connection at the Load, 1000V Model

3.15 Floating and Polarized Output

The SGI Series supply can be set up for a Positive or Negative supply, as well as standard operation as a floating output supply.

FLOATING OUTPUT

The output terminals are normally floating from chassis ground. No extra steps or connections are required for a floating output.

POSITIVE SUPPLY SETUP

Attach the negative output terminal to the supply chassis. The output reference is now chassis ground. When the output voltage is set or programmed, the supply will output a positive potential from chassis ground.

NEGATIVE SUPPLY SETUP

Attach the Positive output terminal to the supply chassis. The output reference is now chassis ground. When the output voltage is set or programmed, the supply will output a negative potential from chassis ground.

CAUTION!

The negative output terminal may be floated up to ±300V (PK), maximum, with respect to chassis ground. Exceeding the limit will be detected as a fault by a protective supervisory monitor and shutdown of the output will be executed; this condition will be latched, requiring reset to resume normal operation.

CAUTION!

Floating the negative output terminal subjects the internal control circuitry of the power supply to the same potential as present at the negative output terminal. In a unit with the standard Non-Isolated Analog Interface, the signals of control connector, J1, would float at the same potential as the negative output terminal. Damage might occur if the signals of the Non-Isolated Analog control connector are connected to an external ground referenced device, due to unintentional ground loop currents that this connection could generate. To correct ground loop problems, it is advised to use the optional Isolated Analog Interface in order to isolate the external signals from the internal control circuitry of the supply. Refer to the Section 1.2.2 for additional information.

3.16 Parallel and Series Operation

Parallel and series modes of operation are used for applications requiring more current or voltage than is available from a single power supply. To meet the requirements for greater output current or voltage, up to five supplies could be connected in parallel, or up to two supplies could be connected in series.

3.16.1 Parallel Operation

In order to connect up to five power supplies in parallel, use a “Master/Slave” daisy-chain wiring configuration as follows; refer to Figure 3-26:

(There are two separate 9-pin connectors on the upper left rear panel of each power supply, marked “PAR OUT” and “PAR IN”).

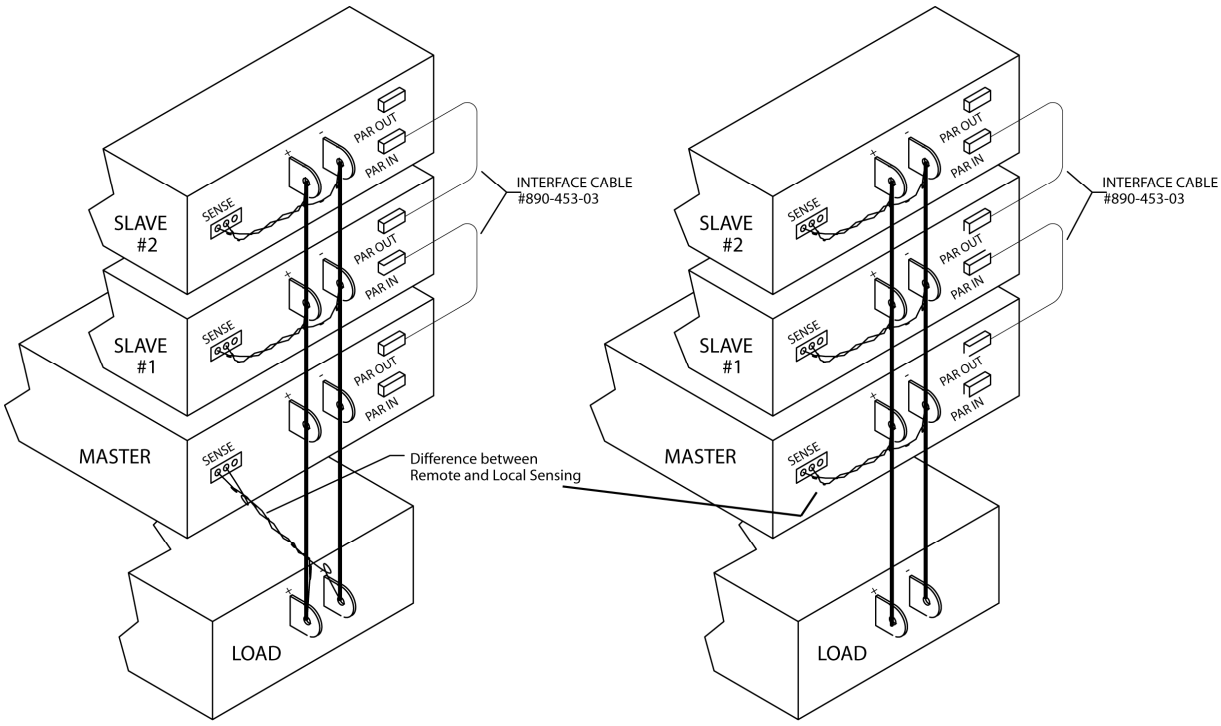
1. Programming, readback, and control is performed through the Master.
2. Beginning with the power supply that is to function as the Master, use an interface cable (P/N 890-453-03) to connect the PAR OUT connector on the designated Master power supply to the PAR IN connector on the second power supply (Slave 1).
3. On the second power supply (Slave 1), use another interface cable to connect the PAR OUT connector to the PAR IN connector of the third power supply (Slave 2). Continue these interconnections up to a maximum of 5 power supplies.
4. Connect the Positive output terminals of all the power supplies and the load.
5. Connect the Negative output terminals of all the power supplies and the load.
6. Confirm that there are no shorts between the Positive and Negative output terminals.
7. Referring to Figure 3-26, connect twisted-pair sense cables as follows; ensure that all twisted-pair cables are as short as possible:

   All slave units shall have twisted-pair cables from their sense terminals to their own output terminals.

   For remote sense at the load, the master unit shall have a twisted-pair cable from its own sense terminals to the load terminals.

   For remote sense at the output terminals (local sense connection), the master unit shall have a twisted-pair cable from its own sense terminals to the output terminals of its own chassis.

Note: *The OVP circuit remains active for all units in parallel operation. If the units are set to different OVP levels, the paralleled system will trip according to the lowest setting. For ease of use, adjust the OVP levels for the slaves to maximum and adjust the master OVP level to the desired setting.*



PARALLEL WITH REMOTE SENSING (block diagram)

NOTE: The voltage display on the slave units will be slightly higher than the master unit.
The twisted pair cable length must be as short as possible.

PARALLEL WITH LOCAL SENSING (block diagram)

NOTE: The twisted pair cable length must be as short as possible.

Figure 3-26. Parallel Connection and Remote Sense

3.16.2 Series Operation

Series operation is used to obtain a higher aggregate output voltage using two units. Each supply is operated individually, and is set up as follows:

Connect the negative terminal (–) of one supply to the positive terminal (+) of the next supply; both units must be of the same model. The total voltage available is the sum of the maximum voltages of each supply. Each supply displays its own output voltage, and the load voltage is the sum of each front panel display.

CAUTION!
Under no condition should the negative (–) output terminal of any power supply exceed 300 V to chassis (earth) ground. This is limited by the isolation and creepage/clearance distances internal to the power supply construction. If a higher output voltage range is required, contact the factory for availability.

Note:

6. The maximum allowable current for a series string of power supplies is the rated output current of a single supply of the string.

7. Remote sensing **at the load** should **not** be used during series operation. Each power supply should have its remote sense leads connected to its own output terminals.

8. An anti-parallel diode (power diode capable of the maximum current of the series group, connected across the output, but reverse biased) is recommended to protect against sinking current into a supply should one supply be “ON” while another other is “OFF.” (Refer to Section 2.6.1).

SECTION 4
CALIBRATION AND VERIFICATION

4.1 Introduction

This section provides calibration and verification procedures for the SGI Series power supplies and the Remote Isolated Analog Interface control (option). Refer to the SG Programming Manual for calibration of display readback and remote digital programming option.

4.1.1 Calibration and Verification Cycle

Annual calibration and verification is recommended. Calibrate only as needed.

4.1.2 Preparation

WARNING!
Hazardous voltages exist at the rear of the supply. Care must be taken to avoid contact with the AC input and DC output terminals. Only authorized personnel should perform this procedure.

Only technically trained personnel, who understand the operation of the power supply and are capable taking accurate readings should perform calibration. The calibration procedures require two digital multimeters and a precision shunt for measurement of voltage and current. To set up for the calibration procedures, perform the following initial steps:

1. Disconnect AC mains power.
2. Connect a precision current shunt, that is suitably derated, across the output of the power supply; a fan might be required to cool the shunt. Connect remote sense leads, and ensure that the digital voltmeter that measures output voltage is connected across the sense leads.

4.2 Calibration and Verification Procedures

WARNING!
Hazardous voltages might be present on the output, even after it is disabled, due to stored capacitive charge. Disconnect the AC mains input, and allow 5 minutes to drain the output capacitive charge to safe levels, before connecting or removing output wiring.

All calibration potentiometers are on circuit board assemblies located at the front of the chassis, and adjustment of the potentiometers is made from the top of the chassis. Refer to Figure 4-1 for the physical location of the potentiometers. Some of the models will require partial removal of the top cover of the chassis to gain access to the potentiometers, dependent on the type of chassis.

The 6U-chassis units and earlier 3U-chassis units have access holes in the top cover that allow adjustment of the calibration potentiometers without removing the top cover. However, if the Ethernet option is installed, some of the potentiometers are covered by a ribbon-cable. To adjust those potentiometers, the cover should be partially removed, and slid towards the rear of the chassis just enough to expose the location of the potentiometers, but with the cover still on top of the chassis. The ribbon-cable should then be carefully moved sufficiently to expose the adjustment screws of the potentiometers.

The latest 3U-chassis units do not have access holes in the top cover, and the top cover must be partially removed to perform calibration. The cover should be slid towards the rear of the chassis just enough to expose the potentiometers, but with the cover still on top of the chassis. If the Ethernet option is installed, a ribbon-cable must be moved, as described above for the 6U-chassis.

When a unit is configured with the Remote Isolated Analog Interface option, calibration must be first performed on that option (refer to Section 4.3), before the standard calibration and verification procedures of Section 4.2 are performed.

4.2.1 Constant-Current Mode

1. Setup the SGI Series unit to operate with remote current programming using an external 0-5 VDC voltage-source, as shown in Figure 3-15 in Section 3.10. Ensure that Pins J1-5 and J1-6 are jumpered to enable the output.

2. Connect a precision current shunt across the output of the power supply, and attach a precision meter across the shunt Kelvin terminals. (see Section 4.1.2).

3. Attach a precision meter in parallel with the current programming voltage-source.

4. Set the current programming source to 0.0 V ±1mV.

5. Program the output voltage, with the front panel control or remote interface, to 100% of rated output voltage.

6. Apply AC power, turn the unit on, and press the "Output On" button to enable the output (see Section 3.1.1).

7. Set the current programming voltage to 5.0 V ±1mV.

8. Verify that the unit produces 100% ±0.8% of rated output current. If necessary, adjust R69 for 100% of rated output current through the shunt.

9. Set the current programming source for 0.5 V ±1 mV.

10. Verify that the unit produces 10% ± 0.8% of rated output current. If necessary, adjust R55 for 10% of rated output current through the shunt.

11. Repeat the steps above as required to obtain the required accuracy.

4.2.2 Constant-Voltage Mode

1. Disconnect the AC mains power to the unit. Remove the current shunt from the output and verify that there is no load attached.

2. Remove the precision meter leads from the current shunt and apply them across the output terminals.

3. Setup the SGI series unit to operate with remote voltage programming using an external 0-5 VDC voltage-source, as shown in Figure 3-17 in Section 3.11. Ensure that Pins J1-5 and J1-6 are jumpered to enable the output.

4. Program the output current, with the front panel control or remote interface, to 100% of rated output current.

4. Apply AC power, turn the unit on, and press "Output On" button to enable the output (see Section 3.1.1).

5. Set the voltage programming source to 5.0 V ±1m V.

6. Verify that the unit produces 100% ±0.25% of rated output voltage. If necessary adjust R74 for 100% of rated output voltage.

7. Set the voltage programming source to 0.5 V ±1 mV.

8. Verify that the unit produces 10% ±0.25% of rated output voltage. If necessary adjust R90 for 10% of rated output voltage.

9. Repeat the steps above as required to obtain the required accuracy.

10. Remove all connections to the remote analog control connector (J1), except the jumper between Pins J1-5 and J1-6; ensure that they are jumpered to enable the output, and allow front panel control.

4.2.3 Resistive-Control Programming Current Sources

(Standard, Non-Isolated Analog Interface Control)

1. Disconnect the AC mains power to the unit.

2. Connect a precision current shunt across the output of the power supply, and attach a precision meter across the shunt Kelvin terminals. (see Section 4.1.2).

3. Setup the SGI series unit to operate with remote current programming using resistance by connecting a 5 kΩ (0.1% or better tolerance) resistor, as shown in Figure 3-14 in Section 3.10. Ensure that Pins J1-5 and J1-6 are jumpered to enable the output.

4. Attach a precision meter across the shunt Kelvin terminals.

5. Apply AC power, turn the unit on, and press “Output On” button to enable the output (see Section 3.1.1).

6. Adjust R35 so that the measured output current equals 100% rated output current.

7. Disable AC power to the unit.

8. Setup the SGI series unit to operate with remote voltage programming using resistance by connecting a 5 kΩ (0.1% or better tolerance) resistor, as shown in Figure 3-16 in Section 3.11. Ensure that Pins J1-5 and J1-6 are jumpered to enable the output.

9. Apply AC power, turn the unit on, and press “Output On” button to enable the output (see Section 3.1.1).

10. Adjust R33 so that the measured output voltage equals 100% rated output voltage.

11. Turn off AC power, and remove all connections to the remote analog control connector (J1), except the jumper between Pins J1-5 and J1-6; ensure that they are jumpered to enable the output, and allow front panel control.

4.2.4 Change Calibration Date

To change the calibration date stored in memory, issue the following SCPI commands (see SG Series Programming Manual for command details) through the remote digital interface, either RS-232, GPIB, or Ethernet:

VIA RS-232 OR GPIB

CAL:UNLOCK “6867”
CAL:DATE YYYYMMDD
CAL:STORE
CAL:LOCK

VIA ETHERNET

CAL:UNLOCK “6867”
CAL:MOD;LASTCALDATE MM DD YYYY
CAL:MOD:NEXTCALDATE MM DD YYYY
CAL:STORE
CAL:LOCK

4.3 Remote Isolated Analog Interface (Option) Calibration and Verification Procedures

9.

CAUTION!
Hazardous voltages may be present on the output, even after it is disabled, due to stored capacitive charge. Disconnect the mains AC input, and allow 5 minutes to drain the output capacitive charge to safe levels before connecting or removing output wiring.

4.3.1 Constant-Current Mode

1. Disconnect AC mains power to the unit. Setup the SGI Series unit to operate with remote current programming using an external 0-5 VDC voltage-source, as shown in Figure 3-15 in Section 3.10. Ensure that Pins J1-5 and J1-6 are jumpered to enable the output.

2. Connect a precision current shunt across the output of the power supply, and attach a precision meter across the shunt Kelvin terminals. (see Section 4.1.2).

3. Attach a precision meter in parallel with the voltage programming voltage-source.

4. Set the voltage programming source to 0.0 V ±1mV.

5. Program the output voltage, with the front panel control or remote interface, to 100% of rated output voltage.

6. Apply AC power, turn the unit on, and press “Output On” button to enable the output (see Section 3.1.1).

7. Set the current programming source to 5.0 V ±1 mV.

8. Verify that the unit produces 100% ±0.8% of rated output current. If necessary, adjust R33 for 100% of rated output current through the shunt.

9. Set the current programming source for 0.5 V ±1 mV.

10. Verify that the unit produces 10% ±0.8% of rated output current. If necessary, adjust R47 for 10% of rated output current through the shunt.

11. Repeat the steps above as needed to obtain the required accuracy.

4.3.2 Constant-Voltage Mode

1. Disconnect AC mains power to the unit. Remove the current shunt from the output and verify that there is no load attached.

2. Remove the precision meter leads from the current shunt and apply them across the output terminals.

3. Setup the SGI Series unit to operate with remote voltage programming using an external 0-5 VDC voltage-source, as shown in Figure 3-17 in Section 3.11. Ensure that Pins J1-5 and J1-6 are jumpered to enable the output.

4. Program the output current, with the front panel control or remote interface, to 100% of rated output current.

5. Apply AC power, turn the unit on, and press “Output On” button to enable the output (see Section 3.1.1).

6. Set the voltage programming source to 5.0 V ±1 mV.

7. Verify that the unit produces 100% ±0.25% of rated output voltage. If necessary adjust R39 for 100% of rated output voltage.

8. Set the voltage programming source to 0.5 V ±1 mV.

9. Verify that the unit produces 10% ±0.25% of rated output voltage. If necessary adjust R35 for 10% of rated output voltage.

10. Repeat the steps above as needed to obtain the required accuracy.

11. Remove all connections to the remote analog control connector (J1), except the jumper between Pins J1-5 and J1-6; ensure that they are jumpered to enable the output, and allow front panel control.

4.3.3 Change Calibration Date

To change the calibration date stored in memory, issue the following SCPI commands (see SG Series Programming Manual for command details) through the remote digital interface, either RS-232, GPIB, or Ethernet:

VIA RS232 OR GPIB

CAL:UNLOCK “6867”
CAL:DATE YYYYMMDD
CAL:STORE
CAL:LOCK

VIA ETHERNET

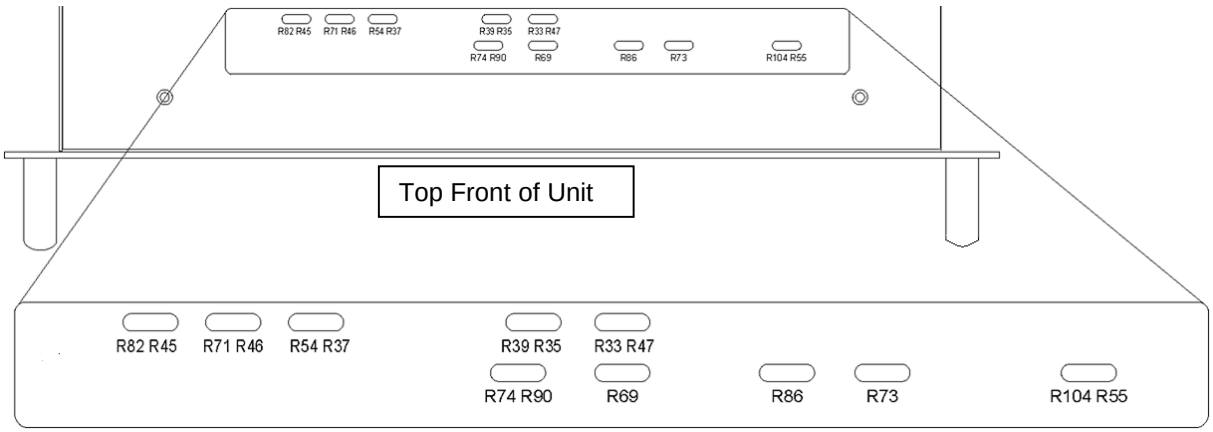
CAL:UNLOCK “6867”
CAL:MOD;LASTCALDATE MM DD YYYY
CAL:MOD:NEXTCALDATE MM DD YYYY
CAL:STORE
CAL:LOCK

Standard Calibration Adjustments
R35 = VPRES (1 mA) Adjust
R33 = IPRES (1 mA) Adjust
R74 = Full-Scale Voltage Adjust
R90 = Zero Voltage Adjust
R69 = Full-Scale Current Adjust
R55 = Zero Current Adjust

Isolated Analog (Option) Calibration Adjustments
R39 = Full-Scale Voltage Adjust
R35 = Zero Voltage Adjust
R33 = Full-Scale Current Adjust
R47 = Zero Current Adjust

Factory Use Only

R37	R45	R46
R54	R71	R73
R82	R86	R104



Top view of potentiometers as located on internal circuit boards.

Figure 4-1. Potentiometer Locations

SECTION 5
MAINTENANCE

5.1 Introduction

This chapter contains preventive maintenance information for the SGI Series power supplies.

WARNING!

All maintenance that requires removal of the cover of the unit should only be done by properly trained and qualified personnel. Hazardous voltages exist inside the unit. Disconnect the supply from the AC mains input before performing any maintenance. Service, fuse verification, and connecting of wiring to the chassis must be accomplished at least 5 *minutes* after AC input power has been removed with an external disconnect switch. Do not touch any circuits and/or terminals that are energized.

5.2 Preventive Maintenance

WARNING!

The OFF position of the front panel power switch does not remove AC input from internal circuits or input terminal blocks. Disconnect external AC input before servicing unit.

CAUTION!

For safe and continued operation of the SGI Series, always operate the unit in a temperature and humidity controlled, indoor area. Exposure to conductive contaminants or corrosive compounds/gases that could be ingested into the chassis could result in internal damage. Keep the rear and sides of the unit free of obstructions to ensure proper ventilation.

No routine maintenance on the SGI Series is required, aside from periodic cleaning of the unit and inspection, as required by the environmental operating conditions:

- Once a unit is removed from service, vacuum all air vents, including the front panel grill.
- Clean the exterior with a mild solution of detergent and water. Apply the solution onto a soft cloth, not directly to the surface of the unit. To prevent damage to materials, do not use aromatic hydrocarbons or chlorinated solvents for cleaning.
- Check external connections for integrity of insulation, loose contacts, and proper torque.
- If there is any evidence of short-circuits or arcing, overheating, or corrosion, contact the factory for recommended service.

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5.3 Fuses

There are no user replaceable components in the power supply. Internal fuses are listed in Table 5–1. Fuses are sized for fault isolation, and, an open fuse might indicate that a circuit component has been damaged. Contact the factory for further assistance..

CAUTION!
To reduce the risk of fire or electrical shock, replace fuses only with the same type and rating.

Assembly	Reference	Rating	Manufacturer Part No.
Bias Supply PWA	F1, F2, F3	5 A, 600V	Littelfuse KLK-5
Power Module Converter Control PWA	F1, F2, F3	30 A, 600V	Littelfuse KLK-30

Table 5–1. Fuse Ratings

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